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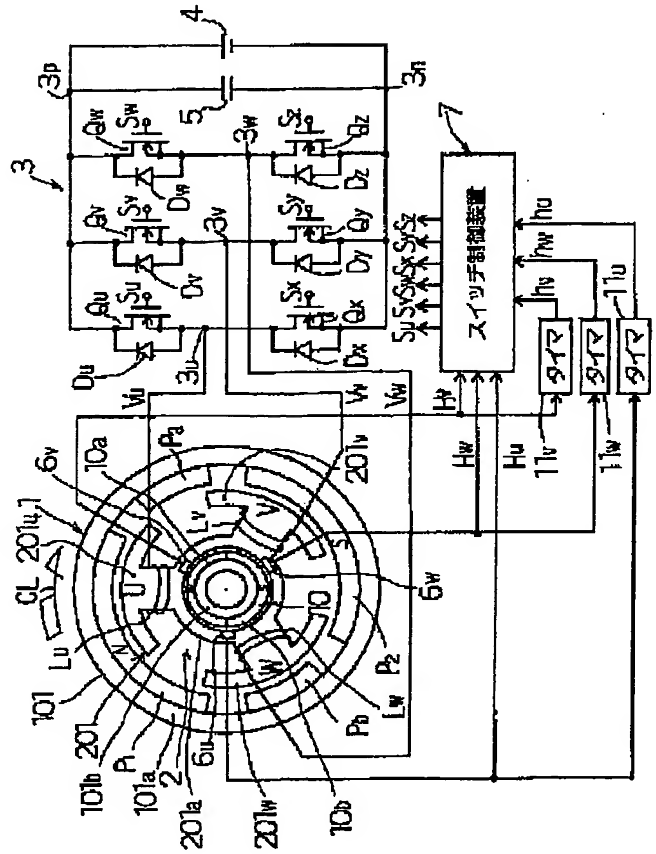
Patent Abstracts of Japan



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APPLICANT : KOKUSAN DENKI CO LTD;

INVENTOR : INABA YUTAKA;

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TITLE : STARTER GENERATOR FOR INTERNAL COMBUSTION ENGINE

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(71)Applicant : KOKUSAN DENKI CO LTD
(72)Inventor : NAKAGAWA MASANORI
INABA YUTAKA

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PROBLEM TO BE SOLVED: To provide a starter generator for internal combustion engine which can be improved in performance as a starting motor and a generator.
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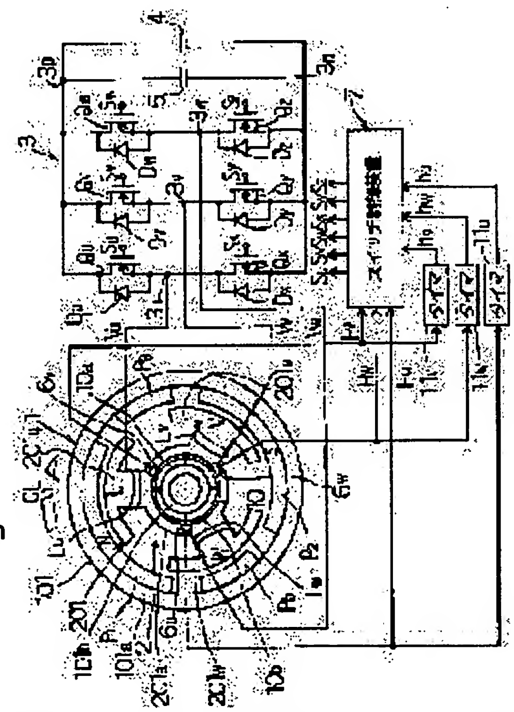

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CLAIMS

[Claim(s)]
[Claim 1] The magnet rotator which is equipped with the magnet field which has a 2m piece (m is one or more integers) rotator magnetic pole, and is attached in an internal combustion engine's crankshaft, So that it may be wound around the tooth part of the armature core which has the tooth part of a large number on a par with a hoop direction, and this armature core and n phase circuit (n is two or more integers) may be constituted The dynamo-electric machine which consists of a stator in which the stator magnetic pole which has the armature coil of n phase which consists of a coil group by which connection was carried out, and counters said rotator magnetic pole at the tip of each tooth part of said armature core was formed, It has n phase diode bridge full wave rectifier circuit constituted by 2n diode by which antiparallel connection was carried out to each of the switching circuit which consists of a switching device in which 2n on-off control by which n phase bridge connection was carried out is possible, and said 2n switching device. The inverter circuit by which a pair of terminal by the side of a direct current of this full wave rectifier circuit was connected to the both ends of a dc-battery, and n terminals of the ac side of this full wave rectifier circuit were connected to n terminals pulled out from the armature coil of said n phase, respectively, It has the inverter control unit which controls the switching device of said inverter circuit to pass the drive current commutated to the armature coil of said n phase by predetermined phase sequence through the switching device of said inverter circuit from said dc-battery. Said magnet rotator is rotated in the direction which operates said dynamo-electric machine as a motor at the time of said internal combustion engine's starting, and starts said internal combustion engine. In the starter generator for internal combustion engines which said dynamo-electric machine is operated as a permanent magnet generator, and passes the charging current to said dc-battery through said full wave rectifier circuit with the induced voltage of the armature coil of said n phase after said internal combustion engine starts The main lobe which consists of a 2m piece circular permanent magnet with which the magnet field of said magnet rotator has predetermined ******, ****** is smaller than said main lobe, and permeability consists of a 2m piece interpole which consists of a high circular ferromagnetism ingredient rather than the permanent magnet which constitutes said main lobe. It has the configuration by which said main lobe and interpole have been arranged by turns in the hoop direction so that one interpole may be arranged at each symmetry at the both sides of each main lobe. Said inverter control unit In case said dynamo-electric machine is operated as a motor Each main lobe of said magnet rotator and one interpole of the contiguity located in the advancing side of the hand of cut of a magnet rotator rather than each main lobe are used as the rotator magnetic pole for motors. In order to rotate said magnet rotator in the direction which starts an engine As opposed to the criteria excitation phase change location for motors or this criteria excitation phase change location for motors set as the location which becomes the relation to which the geometrical hit alignment location of said rotator magnetic pole for motors and the geometrical hit alignment location of the stator magnetic pole at the tip of the tooth part of said armature core around which the armature coil of each phase is wound were set The switching device of said inverter circuit is controlled to pass the drive current commutated to the armature coil of said n phase by predetermined phase sequence through said inverter circuit from said dc-battery, switching the excitation phase of the armature coil of said n phase in the excitation phase change location for motors which has a predetermined control phase angle. In case said dynamo-electric machine is operated as a permanent magnet generator Each main lobe of said magnet rotator, and one interpole of the contiguity located in the delay side of said hand of cut rather than each main lobe as one rotator magnetic pole for generators The criteria excitation phase change location for generators set as the location which becomes the relation to which the geometrical hit alignment location of said rotator magnetic pole for generator machines and the geometrical hit alignment location of the stator magnetic pole at the tip of the tooth part of said armature core around which the armature coil of each phase is wound were set Or in order to pass the control current commutated to said armature coil by predetermined phase sequence through said inverter circuit from said dc-battery, changing an excitation phase in the excitation phase change location for generators which has a predetermined control phase angle to this criteria excitation phase change location

for generators The starter generator for internal combustion engines characterized by being constituted so that the switching device of said inverter circuit may be controlled.
[Claim 2] The magnet rotator which is equipped with the magnet field which has a 2m piece (m is one or more integers) rotator magnetic pole, and is attached in an internal combustion engine's crankshaft, So that it may be wound around the tooth part of the armature core which has the tooth part of a large number on a par with a hoop direction, and this armature core and n phase circuit (n is two or more integers) may be constituted The dynamo-electric machine which consists of a stator in which the stator magnetic pole which has the armature coil of n phase which consists of a coil group by which connection was carried out, and counters said rotator magnetic pole at the tip of the tooth part of said armature core was formed, It has n phase diode bridge full wave rectifier circuit constituted by 2n diode by which antiparallel connection was carried out to each of the switching circuit which consists of a switching device in which 2n on-off control by which n phase bridge connection was carried out is possible, and said 2n switching device. The inverter circuit by which a pair of terminal by the side of a direct current of this full wave rectifier circuit was connected to the both ends of a dc-battery, and n terminals of the ac side of this full wave rectifier circuit were connected to n terminals pulled out from the armature coil of said n phase, respectively, It has the inverter control unit which controls the switching device of said inverter circuit to pass the drive current commutated to the armature coil of said n phase by predetermined phase sequence through the switching device of said inverter circuit from said dc-battery. Said magnet rotator is rotated in the direction which operates said dynamo-electric machine as a motor at the time of said internal combustion engine's starting, and starts said internal combustion engine. In the starter generator for internal combustion engines which said dynamo-electric machine is operated as a permanent magnet generator, and passes the charging current to said dc-battery through said full wave rectifier circuit with the induced voltage of the armature coil of said n phase after said internal combustion engine starts The main lobe which consists of a 2m piece circular permanent magnet with which the magnet field of said magnet rotator has predetermined ******, ****** is smaller than said main lobe, and permeability consists of a 2m piece interpole which consists of a high circular ferromagnetism ingredient rather than the permanent magnet which constitutes said main lobe. It has the configuration by which said main lobe and interpole have been arranged by turns in the hoop direction so that one interpole may be arranged at each symmetry at the both sides of each main lobe. Said inverter control unit In case said dynamo-electric machine is operated as a motor, each main lobe of said magnet rotator and one interpole of the contiguity located in the advancing side of the hand of cut of a magnet rotator rather than each main lobe are used as the rotator magnetic pole for motors. The location which becomes the relation to which the geometrical hit alignment location of each rotator magnetic pole for motors and the geometrical hit alignment location of the stator magnetic pole at the tip of the tooth part of an armature core around which the armature coil of each of said phase is wound were set is detected as a criteria excitation phase change location for motors of each phase. In case said dynamo-electric machine is operated as a permanent magnet generator Each main lobe of said magnet rotator, and one interpole of the contiguity located in the delay side of said hand of cut rather than each main lobe as one rotator magnetic pole for generators The location which becomes the relation to which the geometrical hit alignment location of each rotator magnetic pole for generators and the geometrical hit alignment location of the stator magnetic pole at the tip of the tooth part of an armature core around which the armature coil of each of said phase is wound were set is detected as a criteria excitation phase change location for generators of each phase. The location detection equipment which generates the location detecting signal for generators of each phase including the location detecting signal for motors of each phase including the information on said criteria excitation phase change location for motors, and said information on the criteria excitation phase change location for generators, Said magnet rotator in the direction which starts said internal combustion engine in case said internal combustion engine is started to a rotation **** sake In order to pass a required polar drive current from a dc-battery to said armature coil through the predetermined switching device of said inverter circuit by the location detecting signal for motors of each of said phase A driving signal is given to the predetermined switching device of said inverter circuit in the excitation phase change location for motors which has a predetermined control phase angle to the criteria excitation phase change location for motors or this criteria excitation phase change location detected. After said internal combustion engine starts, in order to make the output voltage pair output current property of said armature coil into an expected property The switch control unit which gives a driving signal to the predetermined switching device of said inverter circuit in the excitation phase change location for generators which has a predetermined control phase angle to the criteria excitation phase change location for generators detected by said location detecting signal for generators, The starter generator for internal combustion engines characterized by providing.
[Claim 3] In case said inverter control unit increases the output of the dynamo-electric machine operated as said permanent magnet generator The location which was overdue to said criteria excitation phase change location for generators in order to have made the magnetic flux which flows through the part by the side of the interpole of each

rotator magnetic pole section for generators increase is made into said excitation phase change location for generators. In case the output of the dynamo-electric machine operated as said permanent magnet generator is controlled, it lets the part by the side of the interpole of each rotator magnetic pole section for generators pass. The starter generator for internal combustion engines according to claim 1 or 2 characterized by making the location to which it went to said criteria excitation phase change location for generators in order to have decreased the flowing magnetic flux into said excitation phase change location for generators.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention works as the motor for starting, and a generator at the time of an internal combustion engine's starting, and after an internal combustion engine's starting is related with the starter generator for internal combustion engines (motor combination power plant for internal combustion engine starting) which works as a generator.
[0002]
[Description of the Prior Art] In order to drive electronic-autoparts loads (for example, the ignition for internal combustion engines, a fuel injection equipment, etc.) indispensable in order to operate an engine or to supply power to at-any-time drive loads, such as a lamp load and a dc-battery, a permanent magnet generator is attached in an internal combustion engine. The permanent magnet generator generally used is constituted by the flywheel magnet rotator attached in an engine's crankshaft, and the stator which looped around and constituted the armature coil in the armature core.
[0003] A ring gear is fixed to the periphery of the peripheral wall section of a flywheel magnet rotator, and the motor for engine starting is attached in an engine's case. When a pinion gear is attached in the output shaft of a motor and a motor drives, a pinion gear jumps out ahead and meshes with a ring gear.
[0004] When the magneto coil prepared in the stator contains the ignition drive coil which generates the electrical potential difference for driving the ignition for internal combustion engines and a motor drives, while rotating an engine's crankshaft by a pinion gear's meshing with a ring gear and rotating a magnet rotator, an internal combustion engine is started by operating an ignition on the electrical potential difference which carries out induction to the ignition drive coil prepared in the stator with rotation of a magnet rotator.
[0005] As mentioned above, since the motor for starting needed to be established while attaching the ring gear in the periphery of a flywheel, in order to put an engine into operation, the conventional internal combustion engine was not able to avoid that an engine's structure became complicated.
[0006] Then, omitting the motor for starting is proposed by operating the permanent magnet generator attached in an engine's crankshaft as a brush loess direct current motor at the time of an engine's starting. The permanent magnet generator which carries out such usage is called the starter generator.
[0007] Drawing 15 is what showed the configuration of this proposed kind of generator, and the load circuit of this generator. It is the radii-like permanent magnet M1 attached in the inner circumference of the peripheral wall section of a flywheel 101 and this flywheel 101 by which 1' was attached in an internal combustion engine's output shaft in this drawing. And M2 The constituted flywheel magnet rotator, 2 is the stator by which armature coil Lu-Lw of a three phase circuit was wound around the tooth parts 201u-201w of the armature core 201 of three poles, respectively, and the dynamo-electric machine which functions as both sides of a generator and a motor by magnet rotator 1' and the stator 2 is constituted.
[0008] Permanent magnet M1 And M2 The direction of each magnetization is changed and it is magnetized in the direction of a path of a rotator so that N pole and the south pole may appear in each inner circumference side.
[0009] It connects with the alternating current side edge child of an inverter circuit 3 who three-phase-circuit star connection of armature coil Lu-Lw is carried out, and consists of switching device Qu-Qw and Qx-Qz in which six on-off control by which three-phase-circuit bridge connection was carried out is possible, and diode Du-Dw and Dx-Dz by which antiparallel connection was carried out to these switching devices, respectively, and the dc-battery 4 and the capacitor 4 for smooth are connected among the direct-current side edge children of an inverter circuit 3.
[0010] Each switching device consists of an MOSFET in the inverter circuit 3 of illustration, and the diode bridge full

wave rectifier circuit which the switching circuit which passes the drive current commutated to armature coil Lu-Lw by predetermined phase sequence from a dc-battery 4 by switching device Qu-Qw and Qx-Qz by which bridge connection was carried out is constituted, rectifies the three-phase-circuit alternating voltage obtained from armature coil Lu-Lw by diode Du-Dw and Dx-Dz, and is impressed to a dc-battery 4 is constituted. The ignition for internal combustion engines and loads which are not illustrated, such as a lamp, are connected to a dc-battery 4.

[0011] In order to decide the excitation pattern at the time of operating the dynamo-electric machine shown in drawing 15 as a brush loess direct current motor, the position transducers 6u-6w which detect the angle-of-rotation location of a magnet rotator to each armature coil of U phase thru/or W phase are formed in the stator 2 side. Position transducers 6u-6w consist of magnetometric sensors, such as a hole IC, and position-transducer 6u prepared to the armature coil of U phase generates the location detecting signal Hu of U phase by detecting the magnetic pole of magnet rotator 1' in the location to which the phase went about 90 degrees by the electrical angle to the armature coil Lu of U phase. Moreover, by detecting the magnetic pole of a magnet rotator in the location to which the phase went about 90 degrees by the electrical angle to the armature coil Lv of V phase, and the armature coil Lw of W phase, respectively, the position transducers 6v and 6w formed to the armature coil Lv of V phase and the armature coil Lw of W phase, respectively output the location detecting signal Hv of V phase, and the location detecting signal Hw of W phase.

[0012] Above-mentioned location detecting-signal Hu-Hw is inputted into the switch control unit 7. The switch control device 7 gives driving signal Su-Sw and Sx-Sz to switching device Qu-Qw and Qx-Qz of an inverter circuit 3 to predetermined timing, respectively, operates the dynamo-electric machine of illustration as a brush loess direct current motor, rotates an engine's crankshaft by this, and starts an engine so that the drive current commutated to armature coil Lu-Lw by predetermined phase sequence from a dc-battery 4 according to the angle-of-rotation location of magnet rotator 1' at the time of an engine's starting may flow.

[0013] After an engine starts, the dynamo-electric machine of illustration is operated as a permanent magnet generator, and the full wave rectifier circuit which consists of diode Du-Dw and Dx-Dz rectifies the three-phase-circuit alternating voltage which carries out induction to armature coil Lu-Lw, and it is impressed by the dc-battery 4.

[0014] Although the case where the armature coil of a three phase circuit was prepared was taken for the example in the above-mentioned example When the armature coil of n phase (n is two or more integers) is prepared, generally location detection equipment The location where the physical relationship between the center position of the magnetic pole section at the tip of the tooth part of an armature core around which the armature coil of each phase is wound, and the center position of each magnetic pole of a magnet rotator turns into relation set up beforehand is detected as a criteria excitation phase change location of each phase. A signal including the information on a criteria excitation phase change location is generated as a location detecting signal of each phase. Moreover, a switch control unit gives a driving signal to the predetermined switching device of an inverter circuit in the excitation phase change location which has a predetermined control phase angle to the criteria excitation phase change location or this criteria excitation phase change location detected by the location detecting signal of each phase so it passes a polar drive current required for a rotation **** sake for a magnet rotator from a dc-battery to an armature coil through the predetermined switching device of an inverter circuit in the direction which starts an internal combustion engine at the time of an internal combustion engine's starting.

[0015] In addition, although a "control phase angle" is the phase contrast of the criteria excitation phase change location detected by location detection equipment, and an actual excitation phase change location (angle-of-rotation location of the rotator at the time of changing the phase of the armature coil which passes a drive current) In this specification, this control phase angle shall take the value of positive/negative. When an actual excitation phase change location turns into a location of the advancing side to a criteria excitation phase change location, a control phase angle is made forward, and when an actual excitation phase change location turns into a location by the side of delay to a criteria excitation phase change location, a control phase angle is made negative.

[0016] In addition, in the brush loess direct current motor more than a three phase circuit, the armature coil of two or more phases is excited at once, and the combination of an excitation phase is changed one by one according to the location of a rotator. Therefore, when the dynamo-electric machine concerning this invention has the armature coil of the polyphase more than a three phase circuit, the excitation phase change location at the time of making it operate as a motor for engine starting at the time of an engine's starting is a location which changes the combination of the excitation phase of an armature coil.

[0017] The above-mentioned criteria excitation phase change location is not uniquely decided by mechanical structure of a dynamo-electric machine, and is decided by the fitting location of the position transducer which constitutes location detection equipment. In the usual brush loess direct current motor, the fitting location of a position transducer is set as a suitable location according to the energization angle (electrical angle) of the drive current passed to the armature coil of

each phase.
[0018] For example Before and behind the location (location where the magnetic flux which flows the tooth part around which the armature coil of each phase was wound passes through a zero point) where the no-load induced voltage which carries out induction to this armature coil when a drive current flows to the armature coil of each phase reaches a peak, to the armature coil of section each phase of 90 degrees (electrical angle) a current In performing 180-degree switching control to pass and rotating a motor The position transducer for obtaining the location detecting signal of each phase so that the angle-of-rotation location of a rotator when the center position (core of a hoop direction) of the magnetic pole section at the tip of the tooth part around which the armature coil of each phase is wound is in agreement with the center position of each magnetic pole of the magnet field of a rotator may be detected is attached.
[0019] For example, as shown in drawing 15 , when the armature coil Lu of U phase thru/or W phase thru/or Lw are wound around three tooth part Pu-Pw In obtaining the location detecting signal of U phase thru/or W phase by detecting the magnetic pole of a magnet rotator using position-transducer 6u thru/or 6w which consists of a hole IC By arranging position transducers 6u-6w in the location to which the phase went about 90 degrees like illustration, respectively from the center position of the magnetic pole section of tooth part 201u thru/or 201w, and detecting the magnetic pole of a magnet field Whenever the center position of each magnetic pole of a magnet field is in agreement with the center position of the magnetic pole section at the tip of tooth parts 201u-201w, usually the location detecting signal of U phase of the shape of a square wave from which level changes thru/or W phase is obtained. In this case, the location whose center position of each magnetic pole of a magnet field corresponds with the center position of the magnetic pole section at the tip of tooth parts 201u-201w turns into the criteria excitation phase change location of U phase thru/or a phase W, respectively, and the criteria excitation phase change location of each phase turns into the location (the standup location and the fall location of a square wave signal) where the level of the location detecting signal of the shape of a square wave acquired from the position transducer of each phase changes.
[0020] moreover, when a drive current flows to the armature coil of each phase, in performing 120-degree switching control which passes a current to the armature coil of section each phase of 60 degrees before and behind the location where the no-load induced voltage which carries out induction to this armature coil reaches a peak and rotating a motor By arranging the position transducers 6u-6w of U phase thru/or W phase in the location to which the phase went about 60 degrees, respectively from the center position of the magnetic pole section of tooth part 201u thru/or 201w, and detecting the magnetic pole of a magnet field Whenever the center position of each magnetic pole of a magnet field is in agreement with the location which was late for the center position of the magnetic pole section at the tip of tooth parts 201u-201w 30 degrees by the electrical angle, usually the location detecting signal of U phase of the shape of a square wave from which level changes thru/or W phase is obtained. In this case, the location when changing into the condition that the center position of each magnetic pole of a magnet field was in agreement with the location which was late for the center position of the magnetic pole section at the tip of tooth parts 201u-201w 30 degrees by the electrical angle turns into a criteria excitation phase change location, and the criteria excitation phase change location of each phase turns into the location where the level of the location detecting signal obtained from the position transducer of each phase changes.
[0021] When performing switching control or 120-degree switching control 180 degrees and rotating a brush loess direct current motor, a position transducer is arranged as mentioned above. When the location detecting signal of each phase is obtained when angle of advance is made into zero By controlling the switching device of an inverter to change the combination of the phase of the armature coil excited in the criteria excitation phase change location (the standup location and fall location of a location detecting signal) where the level of the location detecting signal of each phase changes to a predetermined combination Torque at the time of starting can be made into max. However, the installation location of a location sensor must not always be set up as mentioned above, a criteria excitation phase change location is set as the convenient location for control of an inverter circuit, and a location sensor can be attached so that a detecting signal may be generated in this criteria excitation phase change location.
[0022]
[Problem(s) to be Solved by the Invention] When the armature current is passed like illustration to armature coil Lu-Lw at the time of an engine's starting, this dynamo-electric machine is operated as a starter motor in the dynamo-electric machine shown in drawing 15 which consists of magnet rotator 1' and a stator 2 and magnet rotator 1' is rotated in the direction of arrow-head CL of drawing 16 (clockwise rotation), armature reaction magnetomotive force arises according to the armature current which flows to armature coil Lu-Lw, and this magnetomotive force is a permanent magnet M1. And M2 It acts.
[0023] drawing 16 -- setting -- the coil of armature coil Lu-Lw -- the black dot mark which, as for x marks displayed inside the round mark which shows the cross section of a conductor, the armature current showed that it was flowing

from the front-face side of the space of drawing to the rear-face side, and was shown inside the round mark shows that the armature current is flowing from the rear-face side of the space of drawing to the front-face side. Moreover, Ba shows the synthetic vector (synthetic armature reaction magnetomotive force) of the armature reaction magnetomotive force produced from each coil according to the armature current which flows to armature coil Lu-Lw. The field of the hoop direction of a magnet rotator is divided into N pole field of 180 degrees (pi), and a south pole field, and if the armature reaction magnetomotive force B when the armature current flows like drawing 16 is shown, it will become like drawing 17 . This armature reaction magnetomotive force takes Maximum F and -F in the location of the intermediate shaft between rotator magnetic poles.

[0024] In addition, although armature reaction magnetomotive force does not increase linearly to the location of the intermediate shaft between magnetic poles and depression of magnetomotive force arises near the intermediate shaft between rotator magnetic poles in the part between magnetic poles in fact since the magnetic reluctance of a magnetic path becomes large, the effect of this magnetic reluctance is disregarded in the same drawing shown in drawing 17 and the following.

[0025] The armature reaction magnetomotive force produced according to the armature current which the armature current flows to armature coil Lu-Lw, and flows to the armature coil of each phase as shown in drawing 19 when the conventional starter generator for internal combustion engines of drawing 15 is operated as a permanent magnet generator after the engine started is a permanent magnet M1. And M2 It acts. In drawing 19 , Ba shows the synthetic vector of the armature reaction magnetomotive force produced from each coil according to the armature current which flows to armature coil Lu-Lw, when it operates as a generator. If the magnitude of the magnetic flux B which flows each part of N pole field is roughly shown when synthetic armature reaction magnetomotive force arises like drawing 19 , it will become like drawing 20 .

[0026] The starter generator shown in drawing 15 needs to have the function as a motor for engine starting. Therefore, in this starter generator, to give priority to passing the armature current big enough to an armature coil, and making it generate high torque at the time of an engine's starting, and to decide that coil specification to be it is needed, and it is needed that armature coils are low resistance and a low inductance. Thus, when operating the constituted dynamo-electric machine as a permanent magnet generator after the engine started although it generated high torque and achieved the function as a motor for engine starting when operating it as a motor, it had the problem that where of an output required if it is difficult to generate sufficient generation-of-electrical-energy output and an engine's engine speed does not rise, in order to charge a dc-battery cannot obtain. That is, when the dynamo-electric machine of a coil specification which is suitable as a motor for engine starting is operated as a permanent magnet generator, the I pairs of output current engine-speed N property becomes like the curve a of drawing 14 , and in an engine's low-speed field, at the time of an engine's high speed, an output becomes excessive, and it it not only cannot generate the output for charging a dc-battery, but will be overcharged in a dc-battery. The property of the generator needed in order to charge a dc-battery is a property which an output starts in an engine's low rotational-speed field, and an output is saturated at the time of an engine's high speed, and is restricted like the curve b of drawing 14 at it. Since it is necessary to make [many] the number of turns of an armature coil in order to acquire a property like the curve b of drawing 14 , and it is necessary to make the inductance high, the coil specification turns into a coil specification needed for the motor for starting with an conflicting thing.

[0027] As mentioned above, since the coil specifications needed in order to be satisfied with the motor for starting and the permanent magnet generator for dc-battery charge of the property required of each completely differ, even if the view of using one dynamo-electric machine which has a magnet rotator and the armature coil of a polyphase also [permanent magnet generator / a brush loess direct current motor and / for dc-battery charge], and using as a starter generator is materialized as an idea, the phase of practical use is not yet reached.

[0028] In case the purpose of this invention operates a dynamo-electric machine as a permanent magnet generator after it can acquire high torque required in order to put an engine into operation and an engine starts, in case a dynamo-electric machine is operated as a motor for starting at the time of an engine's starting, it is to offer the starter generator for internal combustion engines which enabled it to obtain high power from an engine's low-speed rotation field.

[0029]

[Means for Solving the Problem] The magnet rotator which this invention equipped with the magnet field which has a 2m piece (m is one or more integers) rotator magnetic pole, So that it may be wound around the tooth part of the armature core which has the tooth part of a large number on a par with a hoop direction, and this armature core and n phase circuit (n is two or more integers) may be constituted The dynamo-electric machine which consists of a stator in which the stator magnetic pole which has the armature coil of n phase which consists of a coil group by which connection was carried out, and counters a rotator magnetic pole at the tip of each tooth part of an armature core was

formed, The inverter circuit which controls the current passed to the armature coil of this dynamo-electric machine, A magnet rotator is rotated in the direction which it has [direction] the inverter control unit which controls this in butter circuit, operates a dynamo-electric machine as a motor at the time of an internal combustion engine's starting, and starts an internal combustion engine. After an internal combustion engine starts, it is involved in the starter generator for internal combustion engines which a dynamo-electric machine is operated as a permanent magnet generator, and passes the charging current to a dc-battery through a full wave rectifier circuit with the induced voltage of the armature coil of n phase.

[0030] The inverter circuit for which this invention is used in the target starter generator It is the thing equipped with n phase diode bridge full wave rectifier circuit constituted by 2n diode by which antiparallel connection was carried out to each of the switching circuit which consists of a switching device in which 2n on-off control by which n phase bridge connection was carried out is possible, and 2n switching device. A pair of terminal by the side of a direct current of a full wave rectifier circuit is connected to the both ends of a dc-battery, and n terminals of the ac side of a full wave rectifier circuit are connected to n terminals pulled out from the armature coil of n phase, respectively.

[0031] An inverter control device controls the switching device of an inverter circuit to pass the drive current commutated to the armature coil of n phase by predetermined phase sequence through the switching device of an inverter circuit from a dc-battery.

[0032] In this invention, it is constituted by the 2m piece interpole which consists of a circular ferromagnetism ingredient with permeability higher than the permanent magnet which ****** is small and constitutes a main lobe rather than the main lobe which the magnet field of the above-mentioned magnet rotator becomes from the 2m piece circular permanent magnet which has predetermined ******, and this main lobe, and a main lobe and an interpole are arranged by turns in a hoop direction so that one interpole may be arranged at each symmetry at the both sides of each main lobe.

[0033] Moreover, in case the above-mentioned dynamo-electric machine is operated as a motor, and in case it is made to operate as a permanent magnet generator, an inverter control unit is constituted so that an inverter may be controlled as follows, respectively.

[0034] namely, in case a dynamo-electric machine is operated as a motor Each main lobe of a magnet rotator and one interpole of the contiguity located in the advancing side of the hand of cut of a magnet rotator rather than each main lobe are used as the rotator magnetic pole for motors. In order to rotate said magnet rotator in the direction which starts an engine As opposed to the criteria excitation phase change location for motors or this criteria excitation phase change location for motors set as the location which becomes the relation to which the geometrical hit alignment location of the rotator magnetic pole for motors and the geometrical hit alignment location of the stator magnetic pole at the tip of the tooth part of an armature core around which the armature coil of each phase is wound were set The switching device of an inverter circuit is controlled to pass the drive current commutated to the armature coil of n phase by predetermined phase sequence through an inverter circuit from a dc-battery, switching the excitation phase of the armature coil of n phase in the excitation phase change location for motors which has a predetermined control phase angle.

[0035] moreover, in case the above-mentioned dynamo-electric machine is operated as a permanent magnet generator Each main lobe of a magnet rotator, and one interpole of the contiguity located in the delay side of said hand of cut rather than each main lobe as one rotator magnetic pole for generators As opposed to the criteria excitation phase change location for generators or this criteria excitation phase change location for generators set as the location which becomes the relation to which the geometrical hit alignment location of the rotator magnetic pole for generator machines and the geometrical hit alignment location of the stator magnetic pole at the tip of the tooth part of an armature core around which the armature coil of each phase is wound were set The switching device of an inverter circuit is controlled in order to pass the control current commutated to an armature coil by predetermined phase sequence through an inverter circuit from a dc-battery, changing an excitation phase in the excitation phase change location for generators which has a predetermined control phase angle.

[0036] The location detection equipment which detects the angle-of-rotation location of the rotator which switches the excitation phase of an armature coil, and the switch control unit which controls the switching device of an inverter circuit based on the timing detected by this location detection equipment can constitute the above-mentioned inverter control unit.

[0037] In this case, location detection equipment In case a dynamo-electric machine is operated as a motor, each main lobe of a magnet rotator and one interpole of the contiguity located in the advancing side of the hand of cut of a magnet rotator rather than each main lobe are used as the rotator magnetic pole for motors. The location which becomes the relation to which the geometrical hit alignment location of each rotator magnetic pole for motors and the geometrical hit alignment location of the stator magnetic pole at the tip of the tooth part of an armature core around which the armature coil of each phase is wound were set is detected as a criteria excitation phase change location for motors of each phase.

In case a dynamo-electric machine is operated as a permanent magnet generator Each main lobe of a magnet rotator, and one interpole of the contiguity located in the delay side of a hand of cut rather than each main lobe as one rotator magnetic pole for generators The location which becomes the relation to which the geometrical hit alignment location of each rotator magnetic pole for generators and the geometrical hit alignment location of the stator magnetic pole at the tip of the tooth part of an armature core around which the armature coil of each phase is wound were set is detected as a criteria excitation phase change location for generators of each phase. The location detecting signal for generators of each phase including the information on the location detecting signal for motors of each phase including the information on the criteria excitation phase change location for motors and the criteria excitation phase change location for generators is generated.

[0038] Moreover, a switch control unit A magnet rotator in the direction which starts an internal combustion engine in case an internal combustion engine is started to a rotation **** sake In order to pass a required polar drive current from a dc-battery to an armature coil through the predetermined switching device of an inverter circuit by the location detecting signal for motors of each phase A driving signal is given to the predetermined switching device of an inverter circuit in the excitation phase change location for motors which has a predetermined control phase angle to the criteria excitation phase change location for motors or this criteria excitation phase change location detected. After an internal combustion engine starts, in order to make the output voltage pair output current property of an armature coil into an expected property A driving signal is given to the predetermined switching device of an inverter circuit in the excitation phase change location for generators which has a predetermined control phase angle to the criteria excitation phase change location for generators detected by the location detecting signal for generators.

[0039] moreover, in case the above-mentioned inverter control unit increases the output of the dynamo-electric machine operated as a permanent magnet generator The location which was overdue to the criteria excitation phase change location for generators in order to have made the magnetic flux which flows through the part by the side of the interpole of each rotator magnetic pole section for generators increase is made into the excitation phase change location for generators. So that the location to which it went to the criteria excitation phase change location for generators in order to have decreased the magnetic flux which flows through the part by the side of the interpole of each rotator magnetic pole section for generators, in case the output of the dynamo-electric machine operated as a permanent magnet generator was controlled may be made into the excitation phase change location for generators It constitutes so that a control phase angle may be adjusted according to the size of the load driven with a dynamo-electric machine.

[0040] The magnet for location detection magnetized so that the above-mentioned location detection equipment might be formed so that it may rotate with a magnet rotator, and it might have a magnetic pole corresponding to the rotator magnetic pole section for motors, The magnetometric sensor of each phase which detects the magnetic pole of the magnet for location detection, and generates the location detecting signal for motors of each phase, the phase of the location detecting signal for motors which the magnetometric sensor of each phase generated -- predetermined ********** -- a location detection signal generation means for generators to obtain the location detecting signal for generators of each phase by things can constitute.

[0041] The magnet for location detection magnetized so that the above-mentioned location detection equipment might be formed again so that it may rotate with a magnet rotator, and it might have a magnetic pole corresponding to the rotator magnetic pole for generators, The magnetometric sensor of each phase which detects the magnetic pole of this magnet for location detection, and generates the location detecting signal for generators of each phase, It can also constitute from a location detection signal generation means for motors to obtain the location detecting signal for motors of each phase, by delaying the phase of the location detecting signal for generators which the magnetometric sensor of each phase generated the degree of predetermined angle.

[0042] The magnet for location detection magnetized so that the above-mentioned location detection equipment might be formed again so that it may rotate with a magnet rotator, and it might have a magnetic pole corresponding to the rotator magnetic pole for motors, or each rotator magnetic pole for generators, It can also constitute from a magnetometric sensor for motors of each phase which detects the magnetic pole of the magnet for location detection, and generates the location detecting signal for motors of each phase, and a magnetometric sensor for generators of each phase which detects the magnetic pole of the magnet for location detection, and generates the location detecting signal for generators of each phase.

[0043] Starter JIENETA to which this invention is applied could be constituted by the rotator abduction form (outer rotor form) where a magnet rotator rotated the outside of a stator, and could be constituted by the rotator inrevolvable (inner rotor form) to which a magnet rotator rotates the inside of a stator.

[0044] Since a flywheel is generally attached in an internal combustion engine, if a magnet rotator is constituted using this flywheel, an engine can be constituted in a compact. In this case, a magnet rotator can be constituted using the

flywheel of the shape of a cup by which it has the peripheral wall section, the bottom wall section which closes the end of the direction of an axis of this peripheral wall section, and the boss section prepared in the center of this bottom wall section, and the boss section is attached in an internal combustion engine's output shaft by attaching a main lobe and an interpole in the inner circumference of the peripheral wall section of this flywheel.

[0045] In this case, a stator is constituted by the armature coil of n phase which consists of a coil group by which connection was carried out so that many tooth parts might be wound around the tooth part of the multi-electrode stellate armature core which has the structure projected to the radial, and this armature core from the annular yoke section and n phase circuit (n is two or more integers) might be constituted, and is arranged inside a magnet rotator.

[0046] If the armature current is passed in order to operate the conventional dynamo-electric machine as shown in drawing 15 as a brush loess direct current motor, as shown in drawing 17 , the field of the advancing side of a rotator magnetic pole will receive a **** operation with the armature reaction magnetomotive force B produced according to the armature current, and the field by the side of delay will receive a demagnetization operation. Since the amount of magnetic flux which increases by the advancing side at this time, and the amount of the magnetic flux which decreases by the delay side are equal, even if the armature current changes, the amount of the magnetic flux which flows through the whole rotator magnetic pole does not change.

[0047] On the other hand, when the interpole which consists of a main lobe which consists of a magnet, and a ferromagnetic ingredient constitutes each rotator magnetic pole of a magnet field like this invention, according to the armature current which flows as shown in drawing 7 , as shown in drawing 8 , the armature reaction magnetomotive force B arises, and the interpole located in the advancing side (front side) of a hand of cut rather than each main lobe with this magnetomotive force is magnetized by the same polarity as each main lobe.

[0048] Therefore, when operating as a motor the dynamo-electric machine which prepared the main lobe and the interpole by turns, each main lobe and the interpole of the contiguity located in the advancing side from each main lobe function as the same polar rotator magnetic pole. That is, each rotator magnetic pole is constituted by each main lobe and the interpole of the contiguity located in the advancing side from each main lobe. In this case, although the amount of the magnetic flux from the first generated from each rotator magnetic pole decreases compared with the part to which the magnetic amount is decreasing, and the thing which constituted the whole rotator magnetic pole with the permanent magnet, if armature reaction magnetomotive force arises, since the magnetic flux which flows through an interpole will increase, much magnetic flux flows rather than the magnetic flux which flows when predetermined conditions are fulfilled and a permanent magnet constitutes the whole rotator magnetic pole.

[0049] Moreover, when operating the dynamo-electric machine which constituted the rotator magnetic pole by the main lobe and the interpole as a brush loess direct current motor, the amount of magnetic flux changes with the excitation phase change locations which switch the excitation phase of the armature coil of n phase. in this case, the geometrical hit alignment location (the center position of a hoop direction --) of each rotator magnetic pole The location of the zero 0 shown in drawing 8 and drawing 9 makes the location which is in agreement with the geometrical hit alignment location (center position of a hoop direction) of the stator magnetic pole at the tip of the tooth part of an armature core around which the armature coil of each phase was wound the criteria excitation phase change location for motors. If the include angle alpha between this criteria excitation phase change location and an excitation phase change location (control phase angle) (refer to drawing 9) is made to increase to the advancing side, the amount of magnetic flux produced from a rotator magnetic pole will decrease as a whole, and the output torque of a motor (a magnet field demagnetized) will decline. Moreover, if the control phase angle alpha is made to increase to a delay side, the amount of magnetic flux will increase and the output torque of a motor (a magnet field ****(ed)) will improve.

[0050] Therefore, when operating the above-mentioned dynamo-electric machine as a brush loess direct current motor, by changing the control phase angle alpha to a delay side, and adjusting the magnitude suitably, in order to start an engine, it can be made the need, sufficient output torque can be obtained, and an engine can be started convenient.

[0051] As mentioned above, the function as a motor for internal combustion engine starting can be given, without making a dynamo-electric machine large-sized especially, since bigger torque than the output torque obtained from the brush loess direct current motor of the same magnitude which constituted the whole rotator magnetic pole with the permanent magnet by setting up a control phase angle suitably can be acquired when operating the dynamo-electric machine which prepared the interpole as a brush loess direct current motor.

[0052] Moreover, since the direction where the armature current flows becomes contrary to the case (in the case of drawing 7) where it operates as a motor, without changing the hand of cut of the rotator of the above-mentioned dynamo-electric machine as shown in drawing 10 when operating this dynamo-electric machine as a permanent magnet generator, as shown in drawing 11 , the armature reaction magnetomotive force B arises, and the interpole of the contiguity located in the delay side of a hand of cut rather than each main lobe with this magnetomotive force is

magnetized by the same polarity as each main lobe. Therefore, in case the above-mentioned dynamo-electric machine is operated as a permanent magnet generator after an internal combustion engine starts, one rotator magnetic pole is constituted by each main lobe and the interpole of the contiguity located in the delay side of a hand of cut rather than each main lobe.

[0053] In this case, the center position (location of the zero 0 shown in drawing 11) of the hoop direction of each rotator magnetic pole makes the location which is in agreement with the center position of the hoop direction of the tooth part of an armature core around which the armature coil of each phase was wound the criteria excitation phase change location for generators. If the include angle alpha between this criteria excitation phase change location for generators and an actual excitation phase change location (control phase angle) is changed to the advancing side to a hand of cut, the amount of magnetic flux produced from a rotator magnetic pole will decrease as a whole, and the output of a permanent magnet generator (a magnet field demagnetized) will decrease. Moreover, if the control phase angle alpha is changed to a delay side to a hand of cut, the amount of magnetic flux will increase and the output of a permanent magnet generator (a magnet field ****(ed)) will increase.

[0054] Thus, if on-off control of the switching device of an inverter circuit is carried out by making into an excitation phase change location the location to which only the predetermined control phase angle alpha went to the criteria excitation phase change location in case the dynamo-electric machine which established the interpole in the magnet rotator is operated as a permanent magnet generator, each rotator magnetic pole can be ****(ed) and the output of a permanent magnet generator can make increase with the armature-reaction magnetomotive force produced from a dc-battery according to the current which flows to an armature coil through an inverter circuit. Therefore, even if the armature coil is wound so that the above-mentioned dynamo-electric machine may achieve the function as a motor for engine starting, and it may have low resistance and a low inductance, in case this dynamo-electric machine is operated as a permanent magnet generator, an output big enough is generated from this generator, and the charging current can be supplied to a dc-battery from an engine's low rotation field.

[0055] In addition, although the location the geometrical hit alignment location of a rotator magnetic pole and whose geometrical hit alignment location of the stator magnetic pole at the tip of the tooth part of an armature core correspond was made into the criteria excitation phase change location in the above-mentioned explanation It is not necessary to necessarily decide a criteria excitation phase change location in this way, and the location which becomes the relation to which the relation between the geometrical hit alignment location of a rotator magnetic pole and the geometrical hit alignment location of the stator magnetic pole at the tip of the tooth part of an armature core was set can be made into a criteria excitation phase change location.

[0056] However, in order to make control easy, it is desirable to define the boundary location of the field which receives a **** operation with armature reaction magnetomotive force, and the field which receives a demagnetization operation as a criteria excitation phase change location. When the interpole which becomes a magnet field from high permeability materials like the dynamo-electric machine used by this invention is prepared In order to influence [many] the part of this interpole by the magnetic part (main lobe part) of armature reaction magnetomotive force, The boundary location of the field which receives a **** operation with armature reaction magnetomotive force, and the field which receives a demagnetization operation turns into a location which approached the interpole side rather than the location the geometrical hit alignment location of a rotator magnetic pole and whose geometrical hit alignment location of the stator magnetic pole at the tip of the tooth part of an armature core correspond.

[0057]

[Embodiment of the Invention] Drawing 1 is what showed the configuration of the starter generator concerning this invention. The flywheel 101 of the shape of a cup by which 1 was attached in an internal combustion engine's crankshaft in this drawing, Main lobe P1 attached in the flywheel 101 And P2 It has Interpoles Pa and Pb. It is the magnet rotator which has the configuration which arranged the main lobe and the interpole in by turns to the hoop direction of a flywheel, and the dynamo-electric machine which operates as a brush loess direct current motor and a permanent magnet generator by this magnet rotator 1 and stator 2 is constituted.

[0058] The flywheel 101 has boss section 101b prepared in the center of peripheral wall section 101a, the bottom wall section, and this bottom wall section, and boss section 101b is attached in an engine's crankshaft.

[0059] Main lobe P1 And P2 ****** formed in the shape of radii consists of an equal permanent magnet, and these main lobes have include-angle spacing of 180 degrees, are arranged, and are being fixed to the inner circumference of peripheral wall section 101a of a flywheel by adhesion etc. Main lobe P1 And P2 The permanent magnet constituted, respectively changes the direction of each magnetization, and is magnetized in the direction of a path of a rotator so that N pole and the south pole may appear in each inner circumference side.

[0060] Interpole Pa is a main lobe P1. It is arranged in the center section of the tooth space between the front end

section of a hand of cut (the direction of arrow-head CL of illustration), and the back end section of the hand of cut of a main lobe P2, and Interpole Pb is the back end section and the main lobe P2 of a hand of cut of a main lobe P1. It is arranged in the center section of the tooth space between the front end sections of a hand of cut. Interpoles Pa and Pb are main lobes P1. And P2 It has include-angle spacing of 180 degrees in the location left 90 degrees to the opposite direction mutually, and is arranged. Interpoles Pa and Pb consist of a ferromagnetic ingredient with high permeability rather than the permanent magnet which constitutes a main lobe.

[0061] The interpole is arranged at the symmetry at the both sides of each main lobe, and the rotator magnetic pole for motors or the rotator magnetic pole for generators is constituted from a magnet rotator used with the starter generator concerning this invention by each main lobe and one interpole of the contiguity.

[0062] That is, in case the dynamo-electric machine shown in drawing 1 is operated as a motor for starting, according to the armature current which flows as shown in drawing 7 , as shown in drawing 8 , the armature reaction magnetomotive force B arises, and the interpole located in the advancing side (front side) of a hand of cut rather than each main lobe with this magnetomotive force is magnetized by the same polarity as each main lobe.

[0063] Therefore, when operating a dynamo-electric machine as a motor, each main lobe and the interpole of the contiguity located in the advancing side from each main lobe function as the same polar magnetic pole. That is, as shown in drawing 2 , it is a main lobe P1. This main lobe P1 One interpole Pa located in the front side (advancing side) of the hand of cut of a magnet rotator works as one rotator magnetic pole m11 for motors. Main lobe P2 This main lobe P2 One interpole Pb located in the advancing side (front side) of the hand of cut of a magnet rotator works as other one rotator magnetic pole m12 for motors.

[0064] Moreover, since the direction where the armature current flows becomes contrary to the case (in the case of drawing 7) where it operates as a motor as shown in drawing 10 in case the dynamo-electric machine of illustration is operated as a permanent magnet generator after an internal combustion engine starts, as shown in drawing 11 , the armature reaction magnetomotive force B arises, and the interpole of the contiguity located in the delay side of a hand of cut rather than each main lobe with this magnetomotive force is magnetized by the same polarity as each main lobe. Therefore, in case the above-mentioned dynamo-electric machine is operated as a permanent magnet generator, it is a main lobe P1. One interpole Pb located in the delay side (back side) of the hand of cut of a magnet rotator is a main lobe P1 by armature reaction magnetomotive force. Since like-pole nature is magnetized, they are these main lobes P1. And Interpole Pb works as one rotator magnetic pole m21 for generators. Moreover, main lobe P2 One interpole Pa located in the delay side (back side) of the hand of cut of a magnet rotator is a main lobe P2 by armature reaction magnetomotive force. Since like-pole nature is magnetized, it is this main lobe P2. And Interpole Pa works as other one rotator magnetic pole m22 for generators.

[0065] The stator 2 which constitutes a dynamo-electric machine with the magnet rotator 1 is fixed to the base plate for stator anchoring which has been arranged inside the magnet rotator 1 and formed in an engine's case etc. The stator 2 of illustration consists of armature coil Lu-Lw of the three phase circuit wound around the tooth parts 201u-201w of the armature core 201 of three poles which made three tooth parts 201u-201w project from annular yoke section 201a to a radial, and the armature core 201 of three poles, respectively.

[0066] In drawing 1 , 3 is an inverter circuit, and this inverter circuit consists of a switching circuit which consists of switching device Qu-Qw and Qx-Qz in which six on-off control by which three-phase-circuit bridge connection was carried out is possible, and a diode bridge full wave rectifier circuit which consists of six diode Du-Dw and Dx-Dz by which three-phase-circuit bridge connection was carried out.

[0067] Furthermore, if it explains in full detail, an end is connected to the other end of switching device Qu-Qw of the surface, respectively with switching device Qu-Qw of the surface of the bridge where common connection of the end was made, and the switching circuit consists of switching device Qx-Qz of the lower side of the bridge where common connection of the other end was made. Each node of the other end of switching device Qu-Qw of the surface and switching device Qx-Qz of the lower side serves as the alternating current side edge children 3u-3w of U phase thru/or W phase, and the terminal by the side of the non-neutral point of armature coil Lu-Lw of U phase by which three-phase-circuit star connection was carried out to the alternating current side edge child of U phase thru/or W phase, respectively thru/or W phase is connected. Moreover, the common node of the end of switching device Qu-Qw of the surface and the common node of the other end of switching device Qx-Qz of the lower side serve as a pair of direct-current side edge children 3p and 3n by the side of a positive electrode and a negative electrode, respectively, and the dc-battery 4 and the capacitor 5 for smooth are connected to juxtaposition, respectively between positive-electrode side direct-current terminal 3p and 3n of negative-electrode side direct-current terminals. The ignition for internal combustion engines and loads which are not illustrated, such as a lamp, are connected to a dc-battery 4.

[0068] In the example of illustration, each switching device consists of an MOSFET, common connection of each drain

is made and FET which constitutes switching device Qu-Qw of the surface of a bridge, respectively is connected to the positive-electrode terminal of a dc-battery 4. Moreover, each source is connected to common connection, now the negative-electrode terminal of a dc-battery 4 while FET which constitutes switching device Qx-Qz of the lower side of a bridge, respectively is connected to the source of FET with which each drain constitutes switching device Qu-Qw of the surface. The capacitor 5 for smooth is connected to the both ends of a dc-battery 4.

[0069] The magnet 10 for location detection magnetized so that it might have a magnetic pole corresponding to the rotator magnetic poles m11 and m12 for motors, respectively is attached in the periphery of boss section 101b of a flywheel 1. The magnet 10 for location detection consists of two permanent magnets 10a and 10b of a semicircle arc, these permanent magnets change the direction of magnetization, and are magnetized in the direction of a path of a flywheel, and the center position of the magnetization field of Magnets 10a and 10b is made in agreement [the center position of the rotator magnetic poles m11 and m12 for motors] in the example of illustration, respectively so that N pole and the south pole may appear in each periphery side.

[0070] The position transducers 6u-6w corresponding to each of armature coil Lu-Lw of a three phase circuit are attached in the part of the inner circumference approach of yoke section 201a of an armature core 201 with include-angle spacing which is 120 degrees. Position transducers 6u-6w consist of a hole IC, and output the voltage signal which takes different level according to the polarity of the magnetic pole which has detected and detected the magnetic pole of the magnet 10 for location detection as location detecting-signal Hu-Hw for motors.

[0071] In this example, in case a drive current is passed from a dc-battery 4 to the armature coil of a three phase circuit through the switching device of an inverter circuit 3 and a generator is operated as a brush loess direct current motor at the time of an internal combustion engine's starting, 180-degree switching control which makes 180 degrees the energization angle of the drive current passed to the armature coil of each phase by the electrical angle shall be performed. In the example of illustration, the method of ordinary arrangement of the position transducer in the case of performing switching control 180 degrees is imitated. Therefore, the position transducer of each phase It is arranged in the location to which the phase went about 90 degrees by the electrical angle rather than the center position of the magnetic pole at the tip of any one tooth part in two or more tooth parts of an armature core around which the corresponding armature coil of a phase was wound. By detecting the polarity of the magnetic pole of the magnet 10 for location detection, the location the center position of each magnetic pole of a magnet field will be in agreement with the center position of the magnetic pole section of the tooth part around which the armature coil of each phase was wound of a location is detected as a criteria excitation phase change location of each phase.

[0072] Location detecting-signal Hu-Hw for motors which position transducers 6u-6w generate, respectively Although what is necessary is just a wave-like signal including the information on the criteria excitation phase change location at the time of operating a dynamo-electric machine as a brush loess direct current motor, when a hole IC is used as a position transducer, this hole IC Since the signal of level which is different in the time of being a time of the polarity of the detected magnetic pole being N pole and the south pole is generated, the wave of a location detecting signal turns into a square wave-like wave, and the standup location and fall location of a location detecting signal of the shape of this square wave turn into a criteria excitation phase change location, respectively.

[0073] The condition which showed in drawing 1 and drawing 2 shows the moment position-transducer 6u detects the trailer (edge located in the back side of a hand of cut) of N pole of the magnet 10 for location detection, and changes the level of the output signal. It detects having changed into the condition that the center position of the magnetic pole m11 of a magnet field was in agreement with the center position of the magnetic pole section of tooth part 201u where the armature coil Lu of U phase was rolled with level change of this signal (having been in agreement with the criteria excitation phase change location of U phase at the time of the angle-of-rotation location of a rotator operating a dynamo-electric machine as a motor).

[0074] 7 is the switch control device constituted using a microcomputer, a logical circuit, etc. this switch control device Position-transducer 6u - 6w The input terminal into which location detecting-signal Hu-Hw outputted, respectively is inputted, It has the output terminal which outputs driving signal Su-Sw and Sx-Sz which are given to each control terminal (the example of illustration gate of MOSFET) of switching device Qu-Qw and Qx-Qz. The magnet rotator 1 in order to pass a polar drive current required for a rotation **** sake through an inverter circuit 3 at armature coil Lu-Lw from a dc-battery 4 in the direction which starts an internal combustion engine at the time of an internal combustion engine's starting A driving signal is given to predetermined MOSFET (switching device) of the switching circuit of an inverter circuit 3 in the excitation phase change location determined based on the criteria excitation phase location detected to armature coil Lu-Lw of a three phase circuit by position transducers 6u-6w.

[0075] The timers 11u-11w for location detection signal generation for U phase thru/or W phases which start actuation are formed. moreover, the time of position transducers 6u-6w generating location detecting-signal Hu-Hw in the

example of illustration, respectively -- a time check -- Time amount by which the timers 11u-11w for location detection signal generation for U phase thru/or W phases are equivalent to the phase contrast theta between the rotator magnetic poles m11 and m12 for motors, and the rotator magnetic poles m21 and m22 for generators (refer to drawing 2) (with the rotational speed of a rotator) differing -- when it clocks, location detecting-signal hu-hw for generators of U phase thru/or W phase is generated, respectively. The location detecting signal of each phase for generators is a signal including the information on the criteria excitation phase change location for generators of each phase the center position of each rotator magnetic pole for generators which consists of each main lobe of the magnet rotator 1 and an interpole of the contiguity arranged rather than each main lobe at the back side of the hand of cut of a magnet rotator, and the center position of the magnetic pole section at the tip of the tooth part of an armature core around which the armature coil of each phase is wound will be in agreement of a phase.

[0076] In this example, with the timers 11u-11w for location detection signal generation for U phase thru/or W phases A location detection signal generation means for generators to obtain the location detecting signal for generators of each phase by things is constituted. the phase of the location detecting signal for motors which the position transducers 6u-6w of a three phase circuit generated -- predetermined ********** -- with this location detection signal generation means for generators Location detection equipment is constituted by the magnets 10a and 10b for location detection, and position transducers 6u-6w.

[0077] When attached in the location to which the position transducers 6u-6w of a three phase circuit went 90 degrees by the electrical angle to the center position of the magnetic pole section of tooth part Pu-Pw where the armature coil of U phase thru/or W phase was wound, respectively like drawing 1 and drawing 2 , If the signal of a high level shall be outputted when a position transducer detects N pole, the wave of location detecting-signal Hu-Hw for motors which position transducers 6u-6w generate, respectively It becomes the wave of the shape of a square wave which carries out sequential generating with the phase contrast of 120 degrees by the electrical angle like (A) - (C) of drawing 5 . Each standup location and fall location of location detecting-signal Hu-Hw for motors turn into a criteria excitation phase change location of U phase at the time of operating a dynamo-electric machine as a motor for starting (brush loess direct current motor) thru/or W phase, respectively.

[0078] The on-off control (180-degree switching control) of each switching device is made to perform in this example, so that each switching device which constitutes a switching circuit may be made into the period ON state of 180 degrees by the electrical angle and the remaining periods of 180 degrees may be made into an OFF state. In this case, the switching pattern of the criteria of switching device Qu-Qw and Qx-Qz is defined like drawing 5 (D) thru/or (I).

[0079] Drawing 5 (D) thru/or (I) are what was shown by the wave of driving signal Su-Sw given to switching device Qu-Qw and Qx-Qz, respectively and Sx-Sz, and the square wave signals of the high level shown in drawing 5 (D) thru/or (I), respectively are driving signal Su-Sw and Sx-Sz. The period when these driving signal Su-Sw and Sx-Sz have occurred is a drive period of switching device Qu-Qw and Qx-Qz, respectively, and the period when driving signal Su-Sw and Sx-Sz have not occurred is a non-driving period of switching device Qu-Qw and Qx-Qz.

[0080] In the criteria switch pattern of the 180-degree switching control shown in drawing 5 As opposed to the armature coil Lu of U phase thru/or W phase thru/or Lw Respectively the angle-of-rotation location of a magnet rotator The period (period when each position transducer has detected one magnetic pole of a magnet field) when the location detecting signal Hu obtained from position-transducer 6u thru/or 6w to detect thru/or Hw have a high level, respectively is made into the switching device Qu thru/or the non-driving period of Qw when the surface of a bridge corresponds. The location detecting signal Hu thru/or Hw make the period which is a low, respectively the switching device Qu thru/or the drive period of Qw when the surface of a bridge corresponds. Moreover, make the switching device Qu of the surface of the bridge of a switching circuit thru/or each non-driving period (period when position-transducer 6u thru/or 6w have detected the magnetic pole of another side of a magnet field, respectively) of Qw into the switching device Qx thru/or the drive period of Qz when the lower side of a bridge corresponds, and let the switching device Qu of the surface of a bridge thru/or the drive period of Qw be the switching device Qx thru/or the non-driving period of Qz when the lower side of a bridge corresponds, respectively.

[0081] If switching device Qu-Qw and Qx-Qz are made to turn on and off by the criteria switch pattern as shown in drawing 5 (D) thru/or (I), the electrical potential difference (induced voltage as a generator) in which rotation of a magnet rotator carries out induction to armature coil Lu-Lw, and alternating voltage in phase will be impressed to armature coil Lu-Lw through the switching circuit constituted from a dc-battery 4 by switching device Qu-Qw and Qx-Qz.

[0082] In the starter generator shown in drawing 1 , the drive current which the switch control unit 7 gives driving signal Su-Sw and Sx-Sz to switching device Qu-Qw and Qx-Qz of an inverter circuit 3 in the predetermined excitation phase change location which has the control phase angle alpha to a predetermined criteria excitation phase change

location or this criteria excitation phase change location, respectively, and commutates to armature coil Lu-Lw by predetermined phase sequence at the time of an internal combustion engine's starting is passed. A permanent magnet generator is operated as a brush loess direct current motor by this, the magnet rotator 1 is rotated, and a power shaft is rotated in the starting direction.

[0083] After an internal combustion engine starts, a dynamo-electric machine is operated as a permanent magnet generator, and a dc-battery 4 is charged with the output obtained from this generator. In case a dynamo-electric machine is operated as a permanent magnet generator In order to make the output voltage pair output current property of an armature coil into an expected property By giving a driving signal to the predetermined switching device of an inverter circuit·3 in the excitation phase change location for generators which has a predetermined control phase angle to the criteria excitation phase change location for generators or this criteria excitation phase change location detected by location detection equipment The output of a generator is adjusted by increasing or decreasing the amount of the magnetic flux interlinked to armature coil Lu-Lw with the magnetomotive force for control which produces the control current from a dc-battery 4 side according to a sink and this control current in armature coil Lu-Lw.

[0084] Here, in order to make an understanding of the principle of this invention easy, the armature reaction of the dynamo-electric machine equipped with the magnet field is explained.

[0085] In the conventional starter generator shown in drawing 15 , when operating a dynamo-electric machine as a brush loess direct current motor by passing the armature current, changing the excitation phase of an armature coil in a criteria excitation phase change location, as shown in drawing 17 , the armature reaction magnetomotive force B arises according to the armature current. This magnetomotive force B is maximum in the location of the intermediate shaft between the poles of a rotator magnetic pole. - F and F are taken. With this armature reaction magnetomotive force, a **** operation arises in the half-section of the advancing side of the hand of cut of a rotator magnetic pole, and a demagnetization operation arises in the half-section by the side of delay. Here, they are an edge location by the side of the delay of the hand of cut of a rotator magnetic pole, and the edge location of the advancing side for a zero 0 about the core of the hoop direction of a rotator magnetic pole, respectively -theta1 And theta 1 When it carries out, it is the armature reaction average magnetomotive force B1 by the side of ****. B1 = {theta1/(pi/2)} Fx(1/2) =theta1 F/pi -- (1)
Moreover, armature reaction average magnetomotive-force B-2 by the side of demagnetization B-2 = {-theta1/(pi/2)} Fx(1/2) =-theta1 F/pi -- (2)
It is come out and given. It is Pm about the permeance of phi and a magnet in the total magnetic flux produced from the magnet which constitutes a rotator magnetic pole here. Magnetic flux phi 1 which will flow the half-section which receives a **** operation of a rotator magnetic pole if it carries out And magnetic flux phi 2 which flows the half-section which receives a demagnetization operation It is given by the following formula.
phi1 =(phi/2)+ (Pm/2) (theta1 F/pi) -- (3)
phi2 =(phi/2)- (Pm/2) (theta1 F/pi) -- (4)
(3) Total magnetic flux phio which flows through a rotator magnetic pole from a formula and (4) types It is set to phio =phi1+phi2 =phi, and the amount of magnetic flux of the whole rotator magnetic pole does not change. That is, in the dynamo-electric machine equipped with the magnet field which the whole rotator magnetic pole becomes from a permanent magnet, in order that a part for **** by armature reaction magnetomotive force and a demagnetized part may balance, even if the armature current flows, the total amount of the magnetic flux which flows through a rotator magnetic pole does not change.

[0086] On the other hand, as shown in drawing 1 , when operating the dynamo-electric machine equipped with the interpole as a brush loess direct current motor, as shown in drawing 8 and drawing 12 , the armature reaction magnetomotive force B arises, and the interpole located in the advancing side rather than each main lobe is magnetized by each main lobe and like-pole nature. Thus, when an interpole constitutes a part of rotator magnetic pole, it is an include angle to the edge by the side of theta 3 and the main lobe of an interpole about the include angle from the core of the hoop direction of a rotator magnetic pole to the edge by the side of the interpole of a main lobe theta 2 If it carries out, the armature reaction average magnetomotive force which acts on a part for a magnetic **** flank will become like the following (5) types.

[0087]
theta3 {/ [/} (pi/2)] Fx(1/2) =theta3 F/pi -- (5)
Moreover, the permeance of a part which receives a **** operation of a magnet is x (Pm/2) (theta 3 / theta 1). -- (6)
The magnetic flux which flows through the part by the side of magnetic **** is x(theta (Pm/2) 3 / theta 1) (theta3 / pi) F. -- (7)
The armature reaction average magnetomotive force which acts on a next door and an interpole is [/(pi/2)] F (1/2).
[{(theta1+theta2) /2}]

= theta1+theta2 F/2pi -- (8)
It becomes. It is PH about the permeance of an interpole here. If it carries out, the magnetic flux which flows through an interpole with armature reaction magnetomotive force is PH. {(theta1+theta2) /2pi} F -- (9)
Moreover, the magnetic flux which flows the part which receives a **** operation of a magnet is x (phi/2) (theta 3 / theta 1), when a magnet constitutes the whole rotator magnetic pole and magnetic flux produced from this magnet is set to phi. -- (10)
It is come out and given.
[0088] (7) Magnetic flux phi 1 which flows through the half-section which adds a formula, (9) types, and (10) types, and receives a **** operation of a rotator magnetic pole When it asks, it is phi1 =(phi/2) x (theta 3 / theta 1).
+ Pm / 2(theta 3 / theta 1) x(theta3 / pi) F +(theta1+theta2) F/2pi -- (11)
Moreover, magnetic flux phi 2 which flows through the part which receives a demagnetization operation with the armature reaction magnetomotive force of a rotator magnetic pole phi2 =(phi/2)-(Pm/2) (theta1 / pi) F -- (12)
(11) Total magnetic flux phio which flows through a rotator magnetic pole from a formula and (12) types When it asks, it is phio =phi1+phi2. =phi(theta1+theta3)/(2theta1)
- Pm/(F/pi) (theta1-theta3) (theta1+theta3) (2theta1)
+ PH (F/pi) {(theta1+theta2) /2} -- (13)
(13) Although the parts of the 1st term of a formula and the 2nd term become small like the straight line a of drawing 6 as the armature current becomes large, the 3rd term becomes large with the increment in the armature current like the curve b of drawing 6 . The magnetic flux which flows through the whole rotator magnetic pole becomes like the curve c of drawing 6 . When an interpole constitutes a part of rotator magnetic pole Since the magnetic volume becomes small, little [(theta1+theta3) / (2theta1) twice] at the time of forming the whole rotator magnetic pole with a magnet the amount of the magnetic flux which flows the whole rotator magnetic pole (13) If the sum of the 2nd term of a formula and the 3rd term becomes phix (theta1-theta3) / (2theta1) above, when a magnet constitutes the whole rotator magnetic pole, much magnetic flux will come to flow from the magnetic flux phi produced from a magnet. This is because magnetic flux tends to flow through the part of an interpole with armature reaction magnetomotive force. In addition, the amount of magnetic flux of the axis of ordinate of drawing 6 is shown as a ratio to the amount of magnetic flux in case the armature current is zero.
[0089] Next, when operating the dynamo-electric machine without an interpole shown in drawing 15 as a brush loess direct current motor, as shown in drawing 18 , the case where only the control phase angle alpha advances an excitation phase change location from a criteria excitation phase change location is considered. Amount phi 1 of the magnetic flux which flows through the part by the side of **** of a rotator magnetic pole at this time phi1 =phix(theta1-alpha)/ (2theta1)+ {Pm/(theta1-alpha) (2theta1)} x {(theta1-alpha) /pi} F -- (14)
Moreover, amount phi 2 of the magnetic flux which flows through the part by the side of demagnetization of a rotator magnetic pole It is given by the following formula.
[0090]
phi2 =phix(theta1+alpha)/(2theta1)-{Pm/(theta1+alpha)} (2theta1) x {(theta1+alpha) /pi} F -- (15)
Therefore, total magnetic flux phiA phiA =phi1+phi2 = phi-Pm F (2 alpha/pi) -- (16)
When the control phase angle alpha is forward, the 2nd term of (16) types is committed as an amount of demagnetization (when advancing an excitation phase change location rather than a criteria excitation phase change location). Moreover, when the control phase angle alpha is made negative, the 2nd term of (16) types is committed as ****** (when an excitation phase change location is delayed rather than a criteria excitation phase change location). Therefore, in a brush loess direct current motor, if a control phase angle is advanced, an output torque will become low, and if a control phase angle is delayed, an output torque will become high.
[0091] Next, like the dynamo-electric machine used by this invention, when a part of rotator magnetic pole is replaced in an interpole, the case where only the control phase angle alpha advances an excitation phase change location rather than a criteria excitation phase change location as shown in drawing 9 is considered. At this time, the magnetic flux which flows through the part which receives a **** operation of a magnet is given by the following formula.
[0092]
{Pm/(theta3-alpha) (2theta1)}, {F/(pi/2)}, {(theta3-alpha) /2}
= Pm {(theta3-alpha) /(2theta1)} and {(theta3-alpha) /pi} F -- (17)
Moreover, the magnetic flux which flows through the part which receives a demagnetization operation of a magnet is given by the following formula.
{Pm/(theta1+alpha) (2theta1)}, {F/(pi/2)}, {(theta1+alpha) /2}
= Pm {(theta1+alpha) /(2theta1)} and {(theta1+alpha) /pi} F -- (18)

Therefore, magnetic-flux phiA which flows through the whole rotator magnetic pole phi =[A] {phi(theta1+theta3)/(2theta1)}- Pm {(theta1+theta3) /(2theta1)} (F/pi)(theta1-theta3+2alpha) + PH [(F/pi) {(theta1+theta2) /2}-alpha] -- (19)
(19) In a formula, if the control phase angle alpha is made forward, the term concerning the control phase angle alpha will be committed as an amount of demagnetization, and the amount of the magnetic flux which flows through a rotator magnetic pole with increase of the armature current will decrease (if an excitation change location is advanced rather than a criteria excitation change location).
[0093] Moreover, if the control phase angle alpha is made negative in (19) types, the term concerning the control phase angle alpha of (19) types will work as ******, and the amount of the magnetic flux which flows through a rotator magnetic pole with increase of the armature current will increase (if an excitation phase change location is delayed to a criteria excitation phase change location).
[0094] The interpole which the interpole which comes to show the armature reaction magnetomotive force B to drawing 11 and drawing 13 (B) since it becomes contrary to the case where the sense of the armature current is a motor when operating the dynamo-electric machine with which the interpole was prepared as a permanent magnet generator, and is located in a delay side rather than each main lobe is magnetized by each main lobe and like-pole nature, and is located in a delay side from each [each main lobe and] main lobe works as an one rotator magnetic pole. Total magnetic flux phiA which flows through a rotator magnetic pole at this time It is given by the following formula.
[0095]
phi =[A] {phix(theta1+theta3)/(2theta1)}- {Pm(theta1+theta3)/(2theta1)} (FG/pi) (theta1-theta3) + PH {(FG/pi) (theta1+theta2) /2} -- (20)
In this invention, in case a dynamo-electric machine is operated as a permanent magnet generator in this way, by controlling an inverter circuit 3, the control current is passed from a dc-battery 4 side to armature coil Lu-Lw through an inverter circuit 3, and as shown in drawing 13 (C), the magnetomotive force Bc for control is generated according to this control current. Thus, if the control current is passed from a dc-battery to an armature coil and it is made to generate the magnetomotive force Bc for control in case a dynamo-electric machine is operated as a generator, the amount of the magnetic flux which flows through a rotator magnetic pole can be controlled by the phase which generates this magnetomotive force Bc for control, and the output characteristics of a generator can be adjusted.
[0096] Namely, in case a dynamo-electric machine is operated as a permanent magnet generator, as shown in drawing 13 (C), the control phase angle alpha is made negative. if an inverter circuit 3 is controlled only for the predetermined phase angle alpha to switch the excitation phase of an armature coil in the location (delay side) of interpole approach, and to pass the control current from a dc-battery to an armature coil rather than the geometrical hit alignment location (criteria excitation phase change location) of a rotator magnetic pole, it will be based on the magnetomotive force for control -- an increase -- demagnetization -- It will be balanced like the permanent magnet generator shown in drawing 15 , and will be in the neutral condition that a generator output does not change from a dc-battery 4 depending on the change in the control current passed to the armature current. Thus, the direction of an interpole part depends on it being easy to be influenced by the main lobe part that the excitation phase change location where a neutral condition is acquired is located in a delay side rather than the geometric center valve position of a rotator magnetic pole of armature reaction.
[0097] Moreover, if the excitation phase change location at the time of passing the control current is delayed from the location where the above-mentioned neutral condition is acquired, since the amount of the magnetic flux which flows through an interpole part with the magnetomotive force for control will increase, the total amount of the magnetic flux which flows through a rotator magnetic pole can be made to be able to increase, and a generator output can be made to increase. Moreover, if the excitation phase change location at the time of passing the control current is advanced from the location where the above-mentioned neutral condition is acquired, since the amount of the magnetic flux which flows through an interpole part with the magnetomotive force for control will decrease, a generator output can be controlled.
[0098] Therefore, in case a dynamo-electric machine is operated as a permanent magnet generator after an internal combustion engine starts, the output of a permanent magnet generator can be made to be able to increase and charge of a dc-battery can be made to start from an engine's low-speed rotation field by setting a control phase angle to a delay side. Moreover, at the time of high-speed rotation of an engine, by setting a control phase angle as the advancing side, the output of a generator can be controlled and overcharge of a dc-battery can be prevented.
[0099] In addition, even when the interpole is not prepared, a generator output can be adjusted by producing the magnetomotive force for control, but since more magnetic flux can be passed through the part of this interpole with the magnetomotive force for control when the interpole is prepared, the controlled variable of the generator output to a

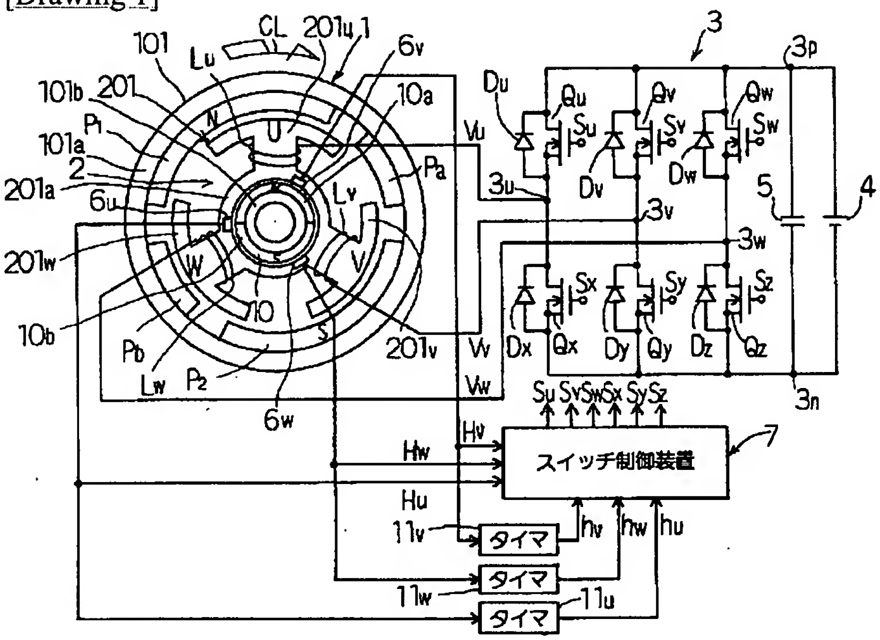
changed part of the control current can be made [many], and control of a generator output can be made easy.
[0100] According to this invention, the thing of the structure equipped with the interpole as a dynamo-electric machine operated as the motor for starting and a permanent magnet generator is used. As mentioned above, in the case of starting In case a dynamo-electric machine is operated as a permanent magnet generator after generating high torque, and making an engine's starting easy and an engine's starting by harnessing the **** effectiveness by armature reaction A generator output can be made to be able to increase sharply and charge of a dc-battery can be made to start from an engine's low-speed rotation field by passing the control current from a dc-battery to an armature coil through an inverter circuit. Moreover, at the time of an engine's high speed, it can prevent controlling a generator output and overcharge of a dc-battery arising by adjusting the phase angle of the control current.
[0101] Drawing 3 shows other examples of a configuration of the starter generator concerning this invention, and drawing 4 shows the configuration of the body part of the starter generator of drawing 3 . In this example, the magnetic pole of the magnet 10 for location detection is detected in the inner circumference section of an armature core 201. U phase, The position transducers 6u, 6v, and 6w for motors of U phase which generates the location detecting signals Hu, Hv, and Hw for motors of V phase and W phase, respectively thru/or W phase, The position transducers 8u, 8v, and 8w for generators of U phase which detects the magnetic pole of the magnet 10 for location detection, and generates the location detecting signals hu, hv, and hw for generators of U phase thru/or W phase thru/or W phase are attached. Location detecting-signal Hu-Hw for motors and location detecting-signal hu-hw for generators are inputted into the switch control unit 7. Other points are the same as that of the starter generator shown in drawing 1 . The position transducers 8u-8w for generators are arranged in the location (front side of the hand of cut of a magnet rotator) in which only the phase contrast theta between the rotator magnetic poles m11 and m12 for motors and the rotator magnetic poles m21 and m22 for generators was behind [the position transducers 6u-6w for motors], respectively.
[0102] Although the location detecting signal for generators was obtained with the timer in the example shown in drawing 1 based on the location detecting signal for motors obtained from the position transducers 6u-6w for motors Since the location detecting signal for direct motors and the location detecting signal for generators can be obtained from the position transducers 6u-6w for motors, and the position transducers 8u-8w for generators in the example shown in drawing 3 , respectively, When controlling the output of a generator, the location of a magnet rotator can be detected without delay and a generator output can be controlled by high degree of accuracy.
[0103] In the above-mentioned example, connection is carried out so that an armature coil may constitute a three-phase circuit, but generally, this invention can be applied, when connecting an armature coil so that the circuit of n phase (n is two or more integers) may be constituted. In connecting an armature coil to n phase, the number of the tooth parts of an armature core is made into nxm (m is one or more integers), and it sets the pole of the magnet field of a magnet rotator to 2xm.
[0104] Although diode Du-Dw and Dx-Dz have been prepared in the above-mentioned example since the rectifier-circuit part of an inverter circuit 3 is constituted, as such diodes, the parasitism diode formed between the drain source on the structure of MOSFET can also be used.
[0105] Moreover, the switching device which constitutes the switching circuit of an inverter circuit 3 is not restricted to MOSFET, and can also use other switching devices in which on-off control, such as a transistor and IGBT (insulated-gate mold bipolar transistor), is possible.
[0106] In the above-mentioned example Before and behind the location (location where the magnetic flux which flows the tooth part around which the armature coil of each phase was wound passes through a zero point) where the no-load induced voltage which carries out induction to this armature coil when a drive current flows to the armature coil of each phase reaches a peak, to the armature coil of section each phase of 90 degrees (electrical angle) a current Although the generator was operated as a brush loess direct current motor when putting an engine into operation by performing 180-degree switching control to pass This invention is not what is limited when performing switching control 180 degrees in this way. For example, by performing 120-degree switching control which passes a current to the armature coil of section each phase of 60 degrees (electrical angle) before and behind the location where the no-load induced voltage which carries out induction to this armature coil when a drive current flows to the armature coil of each phase reaches a peak You may make it make the actuation as a motor perform.
[0107]
[Effect of the Invention] According to this invention, the thing of the structure equipped with the interpole as a dynamo-electric machine operated as the motor for starting and a permanent magnet generator is used. As mentioned above, in the case of starting In case a dynamo-electric machine is operated as a permanent magnet generator after generating high torque, and making an engine's starting easy and an engine's starting by harnessing the **** effectiveness by armature reaction A generator output can be made to be able to increase sharply and charge of a dc-battery can be made

to start from an engine's low-speed rotation field by passing the control current from a dc-battery to an armature coil through an inverter circuit. Moreover, at the time of an engine's high speed, it can prevent controlling a generator output and overcharge of a dc-battery arising by adjusting the phase angle of the control current.

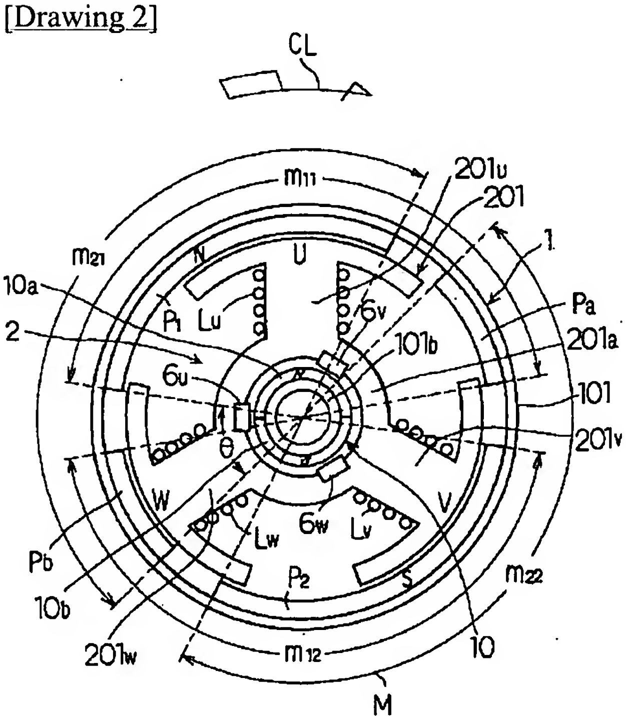
[Translation done.]

DRAWINGS

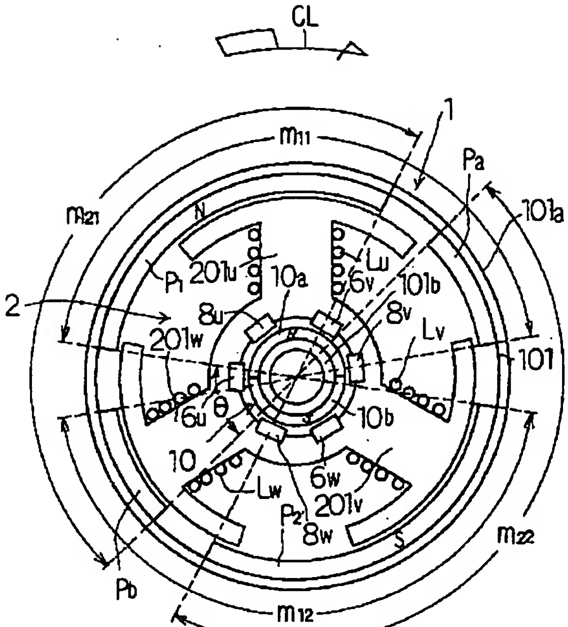
[Drawing 1]



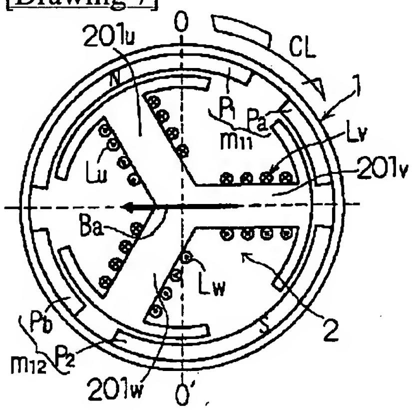
[Drawing 2]



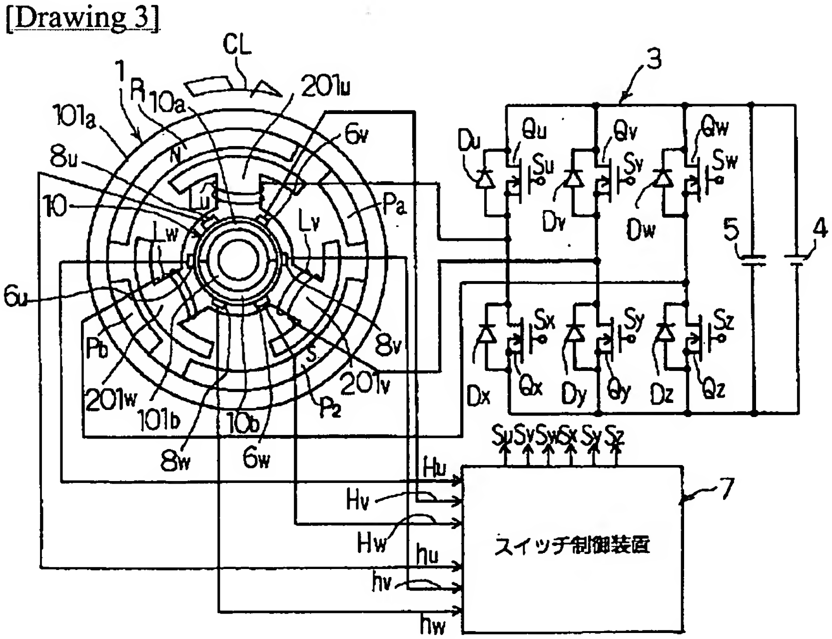
[Drawing 4]



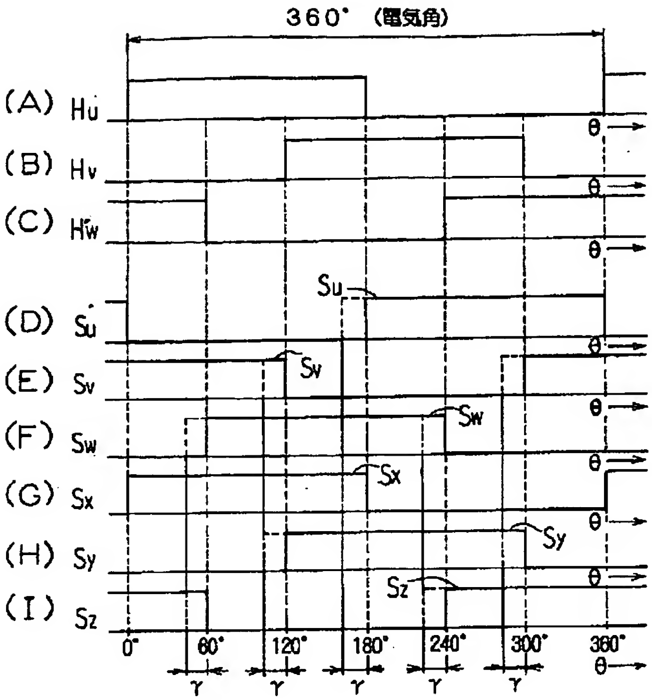
[Drawing 7]



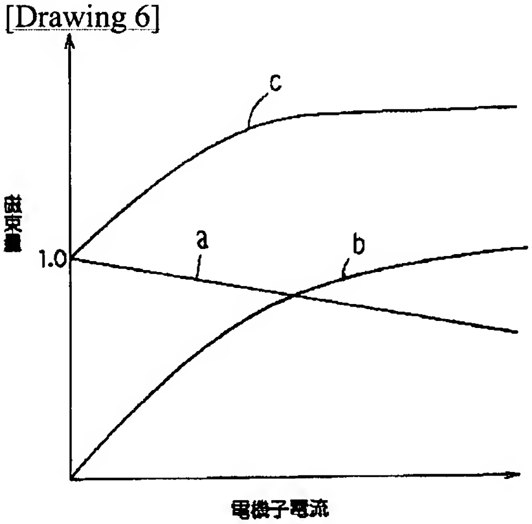
[Drawing 3]



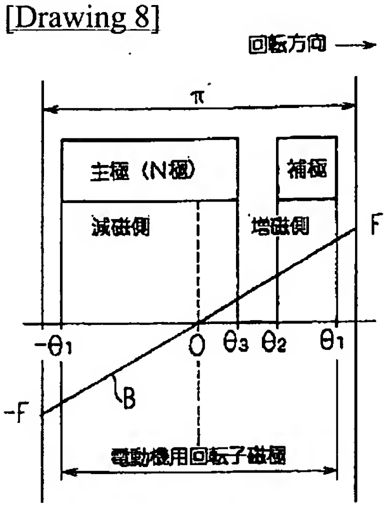
[Drawing 5]



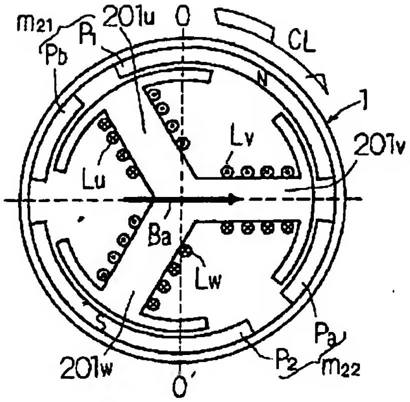
[Drawing 6]



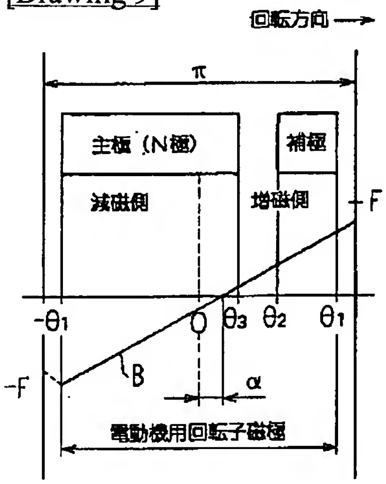
[Drawing 8]



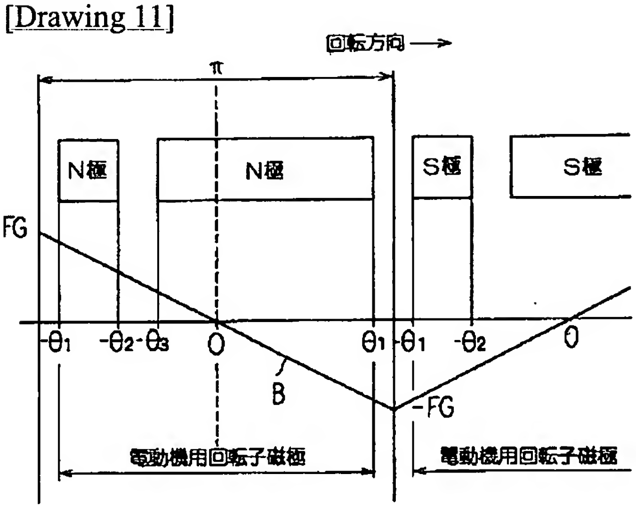
[Drawing 10]



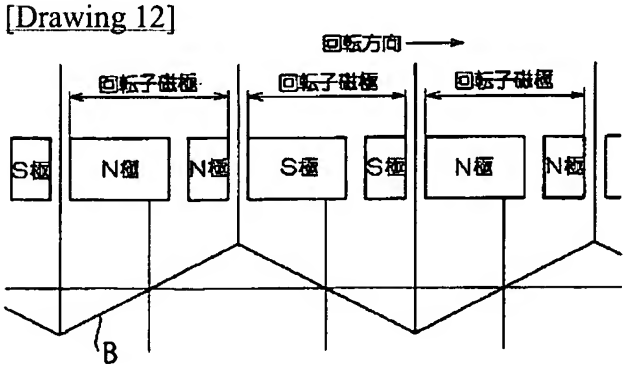
[Drawing 9]



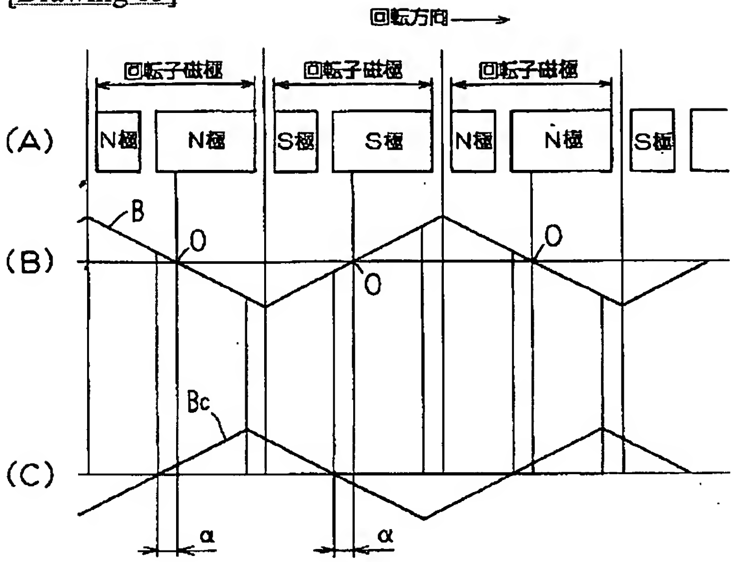
[Drawing 11]



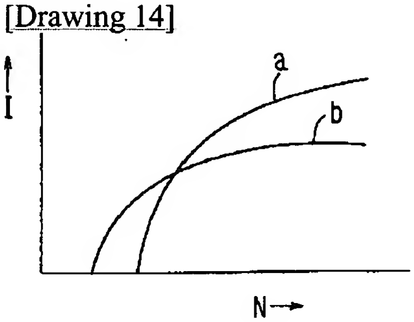
[Drawing 12]



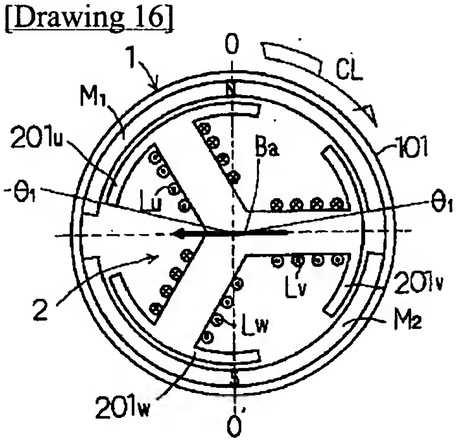
[Drawing 13]



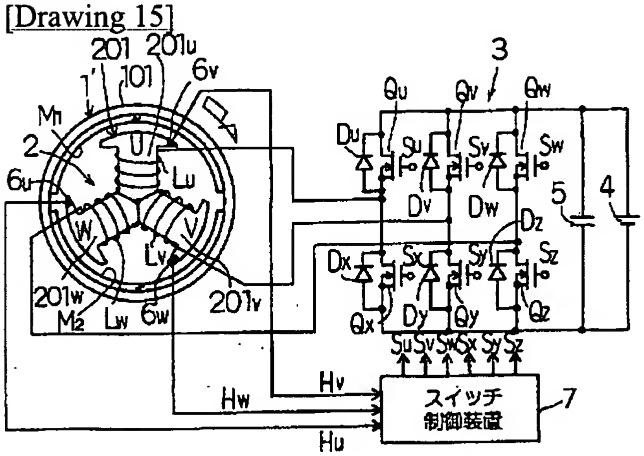
[Drawing 14]



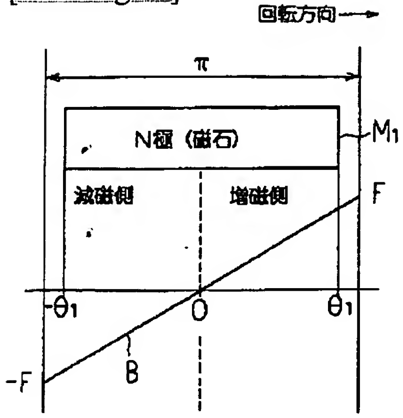
[Drawing 16]



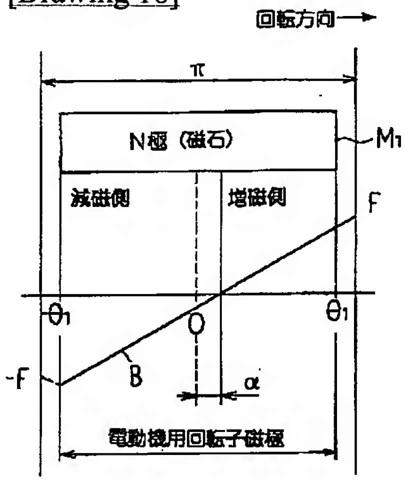
[Drawing 15]



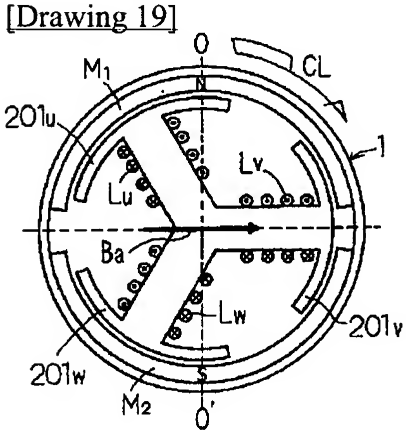
[Drawing 17]



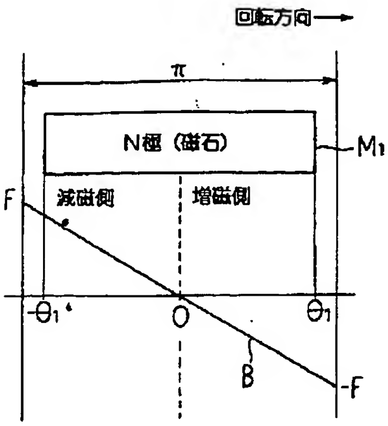
[Drawing 18]



[Drawing 19]



[Drawing 20]



[Translation done.]

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
[Section partition] The 4th partition of the 7th section
[Publication date] January 18, Heisei 14 (2002. 1.18)

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[Application number] Japanese Patent Application No. 11-4410
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H02P   6/20
F02N  11/04
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[FI]

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H02P   6/02    371 B
F02N  11/04        A
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[Procedure revision]
[Filing Date] August 24, Heisei 13 (2001. 8.24)
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] 0029
[Method of Amendment] Modification
[Proposed Amendment]
[0029]
[Means for Solving the Problem] The magnet rotator which this invention equipped with the magnet field which has a 2m piece (m is one or more integers) rotator magnetic pole, So that it may be wound around the tooth part of the armature core which has the tooth part of a large number on a par with a hoop direction, and this armature core and n phase circuit (n is two or more integers) may be constituted The dynamo-electric machine which consists of a stator in which the stator magnetic pole which has the armature coil of n phase which consists of a coil group by which connection was carried out, and counters a rotator magnetic pole at the tip of each tooth part of an armature core was formed, The inverter circuit which controls the current passed to the armature coil of this dynamo-electric machine, A magnet rotator is rotated in the direction which it has [direction] the inverter control unit which controls this inverter circuit, operates a dynamo-electric machine as a motor at the time of an internal combustion engine's starting, and starts an internal combustion engine. After an internal combustion engine starts, it is involved in the starter generator for internal combustion engines which a dynamo-electric machine is operated as a permanent magnet generator, and passes the charging current to a dc-battery through a full wave rectifier circuit with the induced voltage of the armature coil of n phase.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] 0043
[Method of Amendment] Modification

[Proposed Amendment]
[0043] The starter generator with which this invention is applied could be constituted by the rotator abduction form (outer rotor form) where a magnet rotator rotated the outside of a stator, and could be constituted by the rotator inrevolvable (inner rotor form) to which a magnet rotator rotates the inside of a stator.
[Procedure amendment 3]
[Document to be Amended] Specification
[Item(s) to be Amended] 0087
[Method of Amendment] Modification
[Proposed Amendment]
[0087]
theta3 {/ [/} (pi/2)] Fx(1/2) =theta3 F/pi -- (5)
Moreover, the permeance of a part which receives a **** operation of a magnet,
(Pm/2) x (theta 3 / theta 1) -- (6)
Magnetic flux which flows through the part by the side of magnetic ****,
(Pm/2) x(theta3 / pi) F (theta 3 / theta 1) -- (7)
Armature reaction average magnetomotive force which acts on a next door and an interpole,
[{(theta1+theta2) /2} /(pi/2)] F
= theta1+theta2 F/pi -- (8)
It becomes. It is PH about the permeance of an interpole here. Magnetic flux which will flow through an interpole with armature reaction magnetomotive force if it carries out,
PH {(theta1+theta2) /pi} F -- (9)
Moreover, the magnetic flux which flows the part which receives a **** operation of a magnet is, when a magnet constitutes the whole rotator magnetic pole and magnetic flux produced from this magnet is set to phi,
(phi/2) x (theta 3 / theta 1) -- (10)
It is come out and given.
[Procedure amendment 4]
[Document to be Amended] Specification
[Item(s) to be Amended] 0088
[Method of Amendment] Modification
[Proposed Amendment]
[0088] (7) Magnetic flux phi 1 which flows through the half-section which adds a formula, (9) types, and (10) types, and receives a **** operation of a rotator magnetic pole If it asks,
phi1 =(phi/2) x (theta 3 / theta 1)
+ Pm / 2(theta 3 / theta 1) x(theta3 / pi) F
+ PH F/pi (theta1+theta2)
-- (11)
moreover, magnetic flux phi 2 which flows through the part which receives a demagnetization operation with the armature reaction magnetomotive force of a rotator magnetic pole **
phi2 =(phi/2)-(Pm/2) (theta1 / pi) F -- (12)
(11) Total magnetic flux phio which flows through a rotator magnetic pole from a formula and (12) types If it asks,
phio =phi1+phi2
= phi(theta1+theta3)/(2theta1)
- Pm/(F/pi) (theta1-theta3) (theta1+theta3) (2theta1)
+ PH (F/pi) {(theta1+theta2)} -- (13)
(13) Although the parts of the 1st term of a formula and the 2nd term become small like the straight line a of drawing 6 as the armature current becomes large, the 3rd term becomes large with the increment in the armature current like the curve b of drawing 6. The magnetic flux which flows through the whole rotator magnetic pole becomes like the curve c of drawing 6. When an interpole constitutes a part of rotator magnetic pole Since the magnetic volume becomes small, little [(theta1+theta3) / (2theta1) twice] at the time of forming the whole rotator magnetic pole with a magnet the amount of the magnetic flux which flows the whole rotator magnetic pole (13) If the sum of the 2nd term of a formula and the 3rd term becomes phix (theta1-theta3) / (2theta1) above, when a magnet constitutes the whole rotator magnetic pole, much magnetic flux will come to flow from the magnetic flux phi produced from a magnet. This is because magnetic flux tends to flow through the part of an interpole with armature reaction magnetomotive force. In addition, the amount of magnetic flux of the axis of ordinate of drawing 6 is shown as a ratio to the amount of magnetic flux in case the

armature current is zero.
[Procedure amendment 5]
[Document to be Amended] Specification
[Item(s) to be Amended] 0092
[Method of Amendment] Modification
[Proposed Amendment]
[0092]
{Pm/(theta3-alpha) (2theta1)}, {F/(pi/2)}, {(theta3-alpha) /2}
= Pm {(theta3-alpha) /(2theta1)} and {(theta3-alpha) /pi} F -- (17)
Moreover, the magnetic flux which flows through the part which receives a demagnetization operation of a magnet is given by the following formula.
{Pm/(theta1+alpha) (2theta1)}, {F/(pi/2)}, {(theta1+alpha) /2}
= Pm {(theta1+alpha) /(2theta1)} and {(theta1+alpha) /pi} F -- (18)
therefore, magnetic-flux phiA which flows through the whole rotator magnetic pole **
phiA = {phi(theta1+theta3)/(2theta1)} -
Pm {(theta1+theta3) /(2theta1)} (F/pi)(theta1-theta3+2alpha) +
PH [(2 F/pi) {(theta1+theta2) /2}-alpha] -- (19)
(19) In a formula, if the control phase angle alpha is made forward, the term concerning the control phase angle alpha will be committed as an amount of demagnetization, and the amount of the magnetic flux which flows through a rotator magnetic pole with increase of the armature current will decrease (if an excitation change location is advanced rather than a criteria excitation change location).
[Procedure amendment 6]
[Document to be Amended] Specification
[Item(s) to be Amended] 0095
[Method of Amendment] Modification
[Proposed Amendment]
[0095]
phiA = {phix(theta1+theta3)/(2theta1)} -
{Pm(theta1+theta3)/(2theta1)} (FG/pi) (theta1-theta3) +
PH {(2FG/pi) (theta1+theta2) /2} -- (20)
In this invention, in case a dynamo-electric machine is operated as a permanent magnet generator in this way, by controlling an inverter circuit 3, the control current is passed from a dc-battery 4 side to armature coil Lu-Lw through an inverter circuit 3, and as shown in drawing 13 (C), the magnetomotive force Bc for control is generated according to this control current. Thus, if the control current is passed from a dc-battery to an armature coil and it is made to generate the magnetomotive force Bc for control in case a dynamo-electric machine is operated as a generator, the amount of the magnetic flux which flows through a rotator magnetic pole can be controlled by the phase which generates this magnetomotive force Bc for control, and the output characteristics of a generator can be adjusted.

[Translation done.]